THE

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TRADE UNIONS AND POLITICS.

A MOMENTOUS issue is now before those who belong to, and otherwise support, the great Trade Unions of this country. A ballot is being taken upon the question whether these bodies shall use their funds, or part of their funds, for political purposes. The ballot is the result of the Trade Union Act of last year, by which it was made lawful to apply the funds of a Trade Union to political objects if the promotion of such objects was approved by members voting in a secret ballot.

The results of the ballot, so far as they were known on January 6th, supply much food for reflection. In the first place, most of the Unions affiliated to the Labour party have not yet taken a ballot at all, though nine months have elapsed since the Act became law. Certain Unions have, however, taken a ballot and published the results, and it is, to say the least, astonishing to find how small is the majority favourable to political action. For instance, amongst the miners there was only a majority of 67,000 on a total poll of 470,000. When one bears in mind the results of the great strike in 1912, which may properly be ascribed to the political action of the leaders of these men, this result is the more surprising. No fewer than 194,000 miners cast their votes against the expenditure of money on politics. Again, there is great apathy on the point among some Trade Unionists. Thus, less than a third of the members of the Amalgamated Society of Engineers took the trouble to vote on this question.

It is perhaps too early to draw inferences or indulge in generalities, but the portents would seem to show that the influence and usefulness of the Labour Party are on the wane. Possibly the working man is slowly coming to realise the fact that he is better led and cared for by a Trade Union secretary drawn from his own trade than by a whole-time politician who has laid aside the tools of industry for good and all. Such a man is out of touch with the real needs of the worker. If a grievance has to be ventilated and discussed with the employer, the professional politician cannot make a strong appeal to the sympathy of the employer; if a strike has to be settled, the masters resent what they properly consider to be outside interference between themselves and their men. We fancy that if those who lead the Trade Unions were to devote themselves a little more to the interests of their members and a little less to political agitation the cry of the free labourer would not be so much heard. If the energy of the labour leader is devoted to political propaganda, he has no time left to devote to that legitimate object of all Trade Unions—the amelioration of the condition of the working classes. According as the Union becomes identified with a political party, so will it cease to operate as a means of securing better terms for employés.

We hold no brief for any political body, and should be glad to see the relationship of employer and employed wholly removed from the welter of party strife.

So long as the working man continues to place his trust in the worst kind of politician—namely, the man who makes his living by it—the Trade Union will remain divorced from its legitimate and beneficial objects.

The political Trade Union movement is on its trial, and it is interesting at this juncture to recall some of the arguments generally adduced by those who urge that the Trade Union militant is the one hope of salvation for the working man. They argue that every improvement in the conditions and earning power of the working classes is due to the unions, and that the sooner the power of these bodies is extended by entry into the political arena the better. They do not emphasise the fact that the efficiency of the means of production has improved, and this improvement is very largely due to the impulse which Trade Union methods have given to inventive genius. In every department of industry employers have been compelled to take the fullest advantage of labour-saving machinery. If it becomes impossible to obtain workmen except at a minimum wage which renders production unprofitable, the employer will obviously resort to every device to dispense with labour. Nor is the adoption of labour-saving machinery the only remedy for high wages. Better organisation of labour; the employment of young people; the adoption wherever possible of the piecework system, by which the quantum of wages is made to depend upon efficiency—all these remedies tend to the same result. Each and all of them make a demand upon the intellectual capacity of the employer and those about him who are untrammelled and uncontrolled by the dictates of the Trade Unions. Having adopted and practised the ca' canny policy for the last 50 years, the Union leaders are wont to explain away the inevitable result by a general statement that all the added earnings in every industry are due to the worker. As a means of countervailing the evils of their own policy, they generally suggest the annexation and redistribution of the entire wealth of the country on an equitable basis.

As example is better than precept, we cannot do better than refer in this connection to the strike at Leeds which has terminated so fatally for the strikers. Cherishing the belief that they had only to stand firm for 48 hours and the Leeds Corporation would be at their mercy, these misguided men struck *en masse*. The strike failed, owing to the firm attitude adopted by the employers; but it was not an ordinary failure, because there were certain striking *sequelæ*, which ought to teach those who advocate the down-tool policy a serious lesson. In the first place, the Corporation have been able to dictate terms. They found that they were expending £36,000 a year too much on municipal services, and have decided to effect a number of economies. In the second place, they found that by the use of vertical retorts in the gas works an enormous amount of labour might be saved. They had recourse to labour-saving machinery.

The sensible working man may, if he chooses, learn another lesson from the Leeds strike. It is that no matter how well they are led and organised, it is perfectly idle for unskilled labourers to have recourse to this method of securing better conditions of working. Any able-bodied man can sweep a street or empty a dustbin. He can even act as watchman in a municipal park without using faculties of a very high order. Your miner whose thews and sinews have been developed by a long course of practice underground may demand more wages and get them, because the loafer who is leaning up against the wall of the public house cannot do his work. The skilled mechanic who does a job which he or one of his mates alone can do, may sometimes dictate terms to his employer.

We have no doubt that the municipal workers in Leeds who must have lost a large sum in wages, were largely influenced by the arguments of the political Trade Unionist. Those who counselled these unfortunate men to break faith their employers ran no risk of losing their own jobs if their advice proved to be injudicious.

We trust that the result of the ballot now in progress may be to show that notwithstanding the loud protests of a few, there is a majority of workers in this country who would restrict the activity of the Trade Union to its normal and legitimate sphere.

The Employers' Liability Act.

We published last week the report of a case (Watkins *v.* Harrod's Stores, Ltd.) which presents some features of interest in relation to the Employers' Liability Act, 1881. The plaintiff was employed by the defendants as assistant to their chief engineer at a salary of £3 per week and meals on the premises. On August 26th he was told by his superior to keep a special watch on the deep-well pump, which it was his duty to inspect from time to time, in order to see that it did not get overheated. The pump had not been taken over from the contractors who erected it, and on the day when the pump was being tested by the plaintiff in order to see if it worked satisfactorily, his foot was injured, owing, as he alleged, to the absence of a guard. It was said, on behalf of the defendants, that it would have been impossible to fix a guard until after the pump was completed by the makers, and taken over by the defendants.

As our readers are probably aware, the Factory Act, 1901, does not insist upon the fencing of a machine while under repair or under examination in connection with repair. The jury found that the plaintiff was a workman within the meaning of the Employers' Liability Act; that the pump was under examination at the time of the accident; that it was a defect that the pump was not fenced; that the defect was due to the negligence of the chief engineer; that the plaintiff knew and appreciated the risk of the machine being unfenced and undertook the risk; and that the plaintiff was not guilty of contributory negligence. They assessed the damages at £114 1s. The defendants' counsel having submitted that he was entitled to judgment, a consultation took place between the parties, as a result of which it was agreed that the plaintiff should have £16 under the Workmen's Compensation Act, each side paying their own costs.

As an appeal is possible, we do not propose to comment upon the result of the case. It is legitimate to point out, however, that he who proceeds to make a claim under the Employers' Liability Act must do more than prove the mere occurrence of an accident. It is essential to show a defect in the ways, works, machinery or plant, or to prove that the accident was due to the negligence of the employer or one of his servants, to whose orders the plaintiff was bound to conform. We hope to return to this matter at a future date, and to set forth in simple language the true distinction between claims under the Compensation Act and the Employers' Liability Act.

Senghenydd Disaster.

It is rather unfortunate that the Coroner's inquest on the 439 victims of this terrible disaster and the Home Office inquiry should be going on at the same time. It will mean a great deal of inconvenience and trouble to the witnesses and others who are called to give evidence, and will prevent that concentration which is so necessary at inquiries of this description, and especially so at one relating to the most terrible explosion that has yet occurred in the British coalfields.

From the newspaper reports it seems that the manager, Mr. Shaw, is being harassed by the miners' leaders, and apparently much is being made of the fact that bare wires are used for the signalling apparatus, and are said to have emitted sparks. Undoubtedly it appears from the evidence that the regulations required by the Act have not been rigidly adhered to; anyone conversant with the duties of the colliery manager will not wonder at this, and Mr. Shaw, we know, will have the whole-hearted sympathy of his brother colliery managers. Again, the "leaders" must remember that the men they represent have more power than the manager, and if any of them knew there were breaches of the Act, they could easily have taken action.

As regards the causes of the explosion, Mr. Shaw puts forward three theories. One is that an explosive mixture may have been ignited by sparks from a big fall of stone;

the second, that the explosive mixture was ignited at an open lamp in the relighting station; and the third, that the mixture had been carried on and been exploded at a damaged lamp found in the workings. Of these, Mr. Shaw thinks the second theory gives the real cause of the explosion, as an open lamp was found, and there was a considerable development of force observed at the lamp cabin. Why was there an open lamp? Because the principal failing of the ordinary flame safety lamp is that it easily goes out. Accidentally dropping it, or knocking it over, causes it to go out, and it becomes necessary to re-light it. To do this it was—and we may say is—the custom to send the lamp to a lamp station, where the conditions are such that a lamp may be opened in safety and relighted. Evidently the conditions at the moment when the lamp was opened at Universal Colliery were not favourable, and a terrible explosion was the result. The most dangerous and unreliable thing in a gassy mine to-day is the "safety" lamp, and no amount of testing and approval by the Home Office authorities, or anyone else, will ever make the safety lamp "safe."

In our issue of October 31st, 1913, we dealt with this question, and so far the evidence adduced at this inquiry merely confirms the conclusions then arrived at. Remove the ordinary safety lamp by substituting the electric safety lamp, and 99 per cent. of the risk of colliery explosions is gone. We believe this opinion is strongly supported by Mr. Redmayne, H.M. Chief Inspector of Mines. How many more of these dreadful accidents must take place before the mining community in general begins to recognise this fact?

The suggestion that dangerous sparks are emitted from bare signalling wires, to say the least, remains to be proved. In the article above quoted we referred to the results of the experiments carried out by Dr. Thornton, and the American Bureau of Mines, which we think are sufficient to prove that no explosive mixture could be ignited by the "sparks" from bare signalling wires which derive their potential from a few primary cells such as were used in this pit. It appears that the ignition of gas recorded on page 79 of our last issue was effected with new cells and a short connection offering practically no resistance—conditions quite different from those obtaining in practice. We understand, however, expert evidence is to be called as to this point, and we forbear to make any further comments until the issue of Mr. Redmayne's report of the inquiry.

Rubber.

The past year was not one upon which holders of rubber, or of rubber shares, can look back with any pleasurable emotions, for 1913 saw the price of fine plantation grades about cut in half, owing to the more ample quantities available for the use of consumers, while the depreciation in the case of fine hard Para was about one-third, this particular product being more or less under manipulation. One of the outstanding points of the year was the diminished quantity of Brazilian rubber coming forward, but this is not at all a matter for surprise, since the collection of wild rubber, not only in the Amazon Valley but, indeed, in all parts, must tend to shrink with the enormous fall in the selling prices which has been sustained during the last few years. It is really impossible in many cases now to collect wild rubber if the operation is to return a profit to those undertaking it, and the outlook is directly in favour of a marked decrease in such supplies, while, at the same time, the direction of the plantation trade is towards further expansion, as each year, if not each month, new areas become available for the tappers. The development of the plantation trade has been remarkably rapid. The quantities auctioned in London at the periodical auctions were in 1907 only about 800 tons, while in the following year less than 2,000 tons were submitted. By 1910 the total handled at the sales just exceeded 5,000 tons; the following year it was 9,700 tons; in 1912, 17,600 tons, and last year 22,400 tons. Of the total, about one-fifth is Ceylon rubber, and four-fifths material from Malaya. Of course these figures represent only a fraction of the plantation output, which, for the Middle East, is estimated by competent authorities at not far short of 46,000 tons, and in view of the very rapid growth of the supplies available for the use of the trade, it is remarkable that there should have been such a complete absorption of material. The whole course of the rubber market since the boom days came to an end, and there was a clearing up of some of the aftermath of wreckage, has been towards a steady consolidation of the position, and the increase in the consumption has been phenomenal. An object lesson indeed has been provided of the way in which low costs stimulate consumption, and there is no reason why the extension of the use of rubber should not be continued indefinitely while the prices remain reasonable. There can hardly be any great improvement in them from to-day's level unless there is a radical alteration in trade conditions, of which there is no sign, and the line of advance for plantation owners lies, therefore, in cultivating to the utmost the needs of consumers. Even the prices ruling to-day are not at all satisfactory for the better class of plantation company, although they are, of course, no good to concerns floated at fabulous rates near the top of the boom. These concerns were rotten from the start, and their only hope lies in reconstruction if shareholders can be induced to put further money into them, and even then their future is doubtful. For those concerns prepared to cultivate the needs of users there is plenty of satisfaction to be obtained even yet from the selling prices of the product. There is just a chance of the export duty on rubber from the Federated Malay States being reduced soon. If this occurred, it would be a further aid to growers, who, however, will probably see selling prices slip to a yet lower level during the current year, though there is not much room for any further decline, seeing the extent of the depreciation already sustained. Consumers are likely to buy only in conservative fashion for a long while to come, and it is well that matters should proceed quietly for a time in order that the full possibilities of the situation may be gauged. There is a lot more rubber to come forward from the plantations this year than ever before, and what is needed is a period of sober industrial effort so that the new conditions gradually coming into play may take their course, and render it possible for a reasonable estimate to be made of the rate at which both production and consumption may be expected to expand.

The Half-Watt Lamp.

This week the new lamp, whose birth was announced to the world with justifiable pride some five months ago, has made its appearance on the commercial stage, amid the enthusiastic plaudits of its five supporters. Unlike most new-born infants, the half-watt lamp is too big for domestic purposes, and will be turned into the streets at once; but it is of particularly robust constitution, and may be relied upon to take care of itself in the stress of competition in which it will immediately be engaged. That it will exert immense influence on the future of street lighting cannot be doubted; although even its high efficiency falls short of that of the flame arc lamp, the fact that it needs no attention when once installed is a strong point in its favour. The minimum candle-power at present available is 600 C.P., and the average life is put at 800-1,000 hours, so that for all-night burning the renewals, &c., will cost about the same as trimming and depreciation for the flame arc; at 1d. per unit, energy and attendance will cost the same for both, so that the total costs will work out practically equal. Where energy costs more than 1d. per unit the advantage in point of cost will rest with the flame arc. On the other hand, the half-watt lamp can be advantageously employed in streets where the flame arc would be too large a unit, and by using a larger number of smaller lighting units a saving in total candle-power and energy, as well as a better distribution of light, can be effected.

In competition with even the best and latest method of high-pressure gas lighting, the new lamp will have a walk-over; and for the illumination of large halls, shops, work-shops, &c., it will command a very wide market. The electrical industry is to be congratulated upon the splendid weapon now placed at its disposal.

A TRAVELLING X-RAY LABORATORY.

By Dr. ALFRED GRADENWITZ.

While the great importance of X-ray work in military surgery is generally recognized, there is some divergence of opinion as to the kind of apparatus most suitable in warfare. According to some authorities, a light and easily transportable outfit would be preferable, in spite of the unavoidable limitations in efficiency. Others are inclined to prefer a comprehensive high-power installation, though the difficulties of transport in this case, are a decided drawback.

Messrs. Radiguet and Massiot, the well-known French constructors, have made a successful attempt to combine the individual advantages of both schemes, by fitting up an automobile as a travelling X-ray laboratory, containing all the apparatus required for even the most delicate work.

The vehicle comprises a 12 h.p. Lorraine-Dietrich chassis with a 4-cylinder motor (of 75 mm. bore and 120 mm. stroke), a leather cone clutch and a 3-speed gear box. The strength of the springs has been calculated most amply. The body is closed entirely, the roof comprising a light canopy for protecting the driver. Two side doors with red glass panes are provided, and the heavy parts of the outfit are arranged in the large rear compartment, closed by a folding panel.

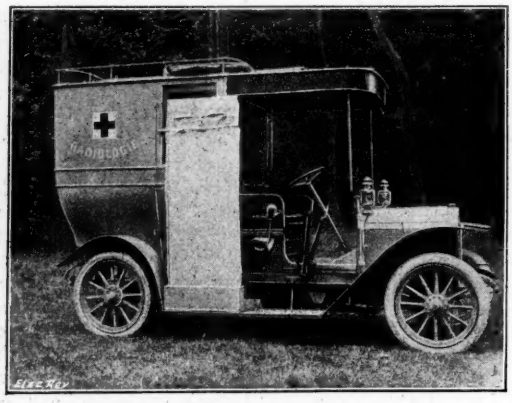


Fig. 1.—Travelling X-ray Laboratory.

The interior appointments of the laboratory car comprise all the various apparatus in a relatively limited space. A large work table has been provided for charging the slides comfortably, allowing the plates to dry, etc. The plates are developed and fixed in a lead-coated trough. Water is supplied from a tank of 30 litres capacity connected to a tap over the developing trough, and which can be filled from outside. Lead and felt-lined casings are provided for protecting the plates, paper and chemicals against jerks and the noxious action of X-rays. A box fitted with special buffers contains the X-ray bulbs.

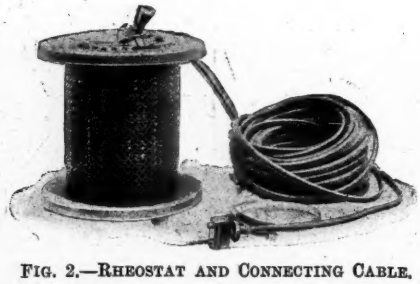


Fig. 2.—Rheostat and Connecting Cable.

The electrical energy required to feed the X-ray outfit and to recharge the accumulator battery (of 40 amp.-hours) of the lighting circuit is supplied by a 110-volt, 15-amp., dynamo, switched on to the motor; a voltmeter serves to check and control the pressure, by varying the speed of the latter. From the dynamo, the current is taken to the switchboard, whence it is distributed to the various apparatus. A searchlight of small weight and a range of 800 metres, fed from the dynamo, may be installed for searching the battle-field for wounded soldiers.

On account of the urgent need for means allowing all parts of the body, inclusive of the thorax and pelvis, to be rapidly examined, a most efficient X-ray outfit had to be provided.

The transformer, the resistances for controlling the intensity of the primary current and the whole of the high-tension circuit, were, for different reasons, placed close to the patient. The operator is thus in a position himself to choose and control the working conditions of the X-ray bulb; moreover, he is able readily to send intermittent low-tension current to any distance desired, whereas great difficulty would have been experienced in transmitting high-tension current from the car to a more or less distant point of utilisation. The transformer comprises two primary windings, for low and high intensities respectively.

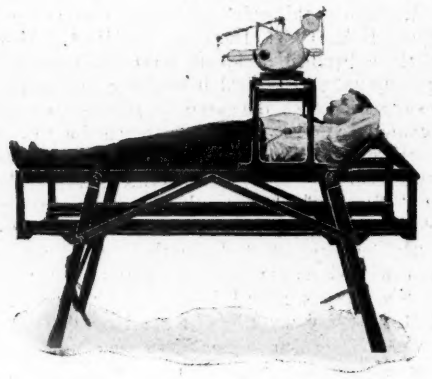


Fig. 3.—Table Arranged for Ventro-Dorsal Radiography

The secondary current is distributed by an instantaneous switch to the various apparatus (rectifier, spark-gap, &c.).

The upper part of the transformer carries a folding switchboard on which the milliammeter and rectifier have been installed. Since the connection plugs are non-reversible, the current always flows in the proper direction. During transport, the transformer switchboard is folded down and the whole is placed in an oaken box fitted with handles.

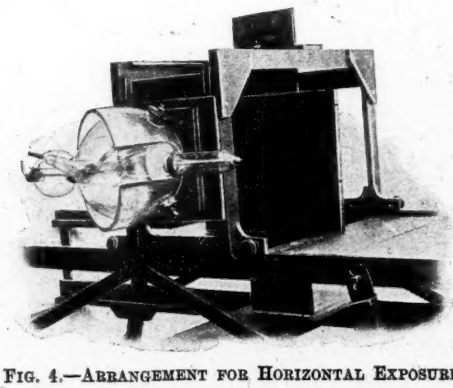


Fig. 4.—Arrangement for Horizontal Exposure.

The intensity of the primary current is controlled

by a rheostat (fig. 2), the reel of which carries two windings (for low and high intensities respectively); a switch allows the proper resistance to be chosen. The junction cable 25 metres in length is, during transport, wound on the same reel and fixed by means of two belts.

In order to reduce the number of apparatus to a minimum, while ensuring a maximum of rigidity in the bulb-holder, a special type of operation table had to be devised. Fig. 3 shows this table, as arranged for a ventro-dorsal radiography and fig. 4, for horizontal X-ray exposure. When placing the bulb on the lower frame of the bed, the same arrangement can be used for X-ray examination (radioscopy) of any part of the body. The bulb-holder is readily fitted to any part of the table.

In addition to all essential apparatus, the car also comprises a radioscopic dark chamber for X-ray examination in full daylight, a plate holder allowing a reinforcing screen to be inserted, a pair of protective gloves, a pair of protective spectacles, and a number of accessories, such as photographic plates kept in a lead lined drawer, highly insulated conductive wires, etc.

FIG. 5.—TRAVELLING X-RAY LABORATORY, WITH TENT FITTED UP.

The outfit is readily operated without any special training, the car being set working within 5 minutes.

Since all the apparatus are carried on the same vehicle, there is practically no risk of losing any. The outfit is so complete as to allow even the most complicated operations to be readily carried out and therefore is likely to prove of service also in times of peace, *e.g.*, on aviation grounds, in minor military hospitals, &c.

FURTHER NOTES ON ACZOLLING POLE TIMBER.

SOME eighteen months ago, some notes were published in these columns concerning the aczolling of pole and other timber. The material employed in this preservative process is, it will be remembered, a mixture of metallic ammoniates with an antiseptic acid containing the essential preservative elements of creosote, viz., phenols and naphthalene. The advantages claimed for this compound are that the powerful preservative action of the phenols is added to the antiseptic value of the metallic salts and that, owing to the solubility of cellulose and vasculose in aczol (see ELECTRICAL REVIEW, June, 1912, p. 1060), the surface layers of the fibres and tissues of the wood treated are dissolved and subsequently, by combined chemical and physical action, cemented together by a stable and permanent sheathing. Even more important than the powerful antiseptic and preservative value of the compound is the complete fixation and hence permanence of action of its essential ingredients. In addition to the information already presented, the following data are now available concerning the use of aczol and the results secured by its application.

As sold, aczol contains from 15 per cent. to 30 per cent. of reinforced phenols and the equivalent of 30 per cent. of copper and zinc salts. The results of Malenkovie's experiments show that 0.13 per cent. of phenol or 3 per cent. of copper and zinc salts suffice to sterilise gelatine which is, of course, much more susceptible than wood to fungus or insect attack. The concentrated material therefore represents about 150 times the preservative power actually required to effect sterilisation and, since the characteristic feature of aczol is its ability to form a stable compound with cellulose in which the whole of the preservatives introduced are fixed permanently, it is possible to use it in a very dilute solution. Woodwork not to be buried in soil or exposed continuously to weather can frequently be sufficiently protected by surface painting with a one in five or six solution of concentrated aczol in water. Generally it is preferable to impregnate timber thoroughly, and this should certainly be done in the case of telegraph poles.

Injection may be effected by simple immersion for one or two weeks, but wherever the simple equipment required can be erected, pressure injection should be practised. In any case, the solution is used cold. Though aczol itself is perfectly soluble in water, the compounds which it forms with cellulose are insoluble in hot or cold water and are unaffected by salt water, carbon-dioxide, or its solution or salts. Timber is not rendered oily or in any way unpleasant by the aczolling process, neither is its weight seriously increased. The wood can be painted or even polished after treatment and by varying the proportions of the ingredients of the compound, timber can be rendered waterproof and non-flammable at will. Saturating timber with any oily substance reduces its strength appreciably, but the cementing action of aczol within the timber increases considerably the strength of the latter.

No salts injurious to timber or capable of corroding iron or other metals are contained by aczol or can be formed from it; the insulating value of wood is not reduced by the treatment. Assuming 1.33 gallons of aczol solution to be injected per cb. ft. of timber treated, the life and average annual cost of pole timber compare favourably with the corresponding data for creosoting. In this connection the following table is interesting:—

Treatment.	Cost per cb. ft.		Life of pole years.	Outlay per cb. ft.	
	Treatment.	Pole erected.		In 24 years.	Per annum.
	d.	s. d.		s. d.	d.
Untreated wood ...	nil	1 4½	6	5 6	2¾
Metallic salts... ...	3	1 6	12	3 0	1½
Creosote	6	1 8	24	1 8	¾
Aczol	2½	1 5½	24 (min.)	1 5½	½

Electric Light on French Railway Trains.—The French Minister of Public Works has issued a circular urging railway companies to adopt electric lighting on their fast trains, pointing out that a recent disaster has again demonstrated that collisions between trains often give rise to fires, and that it is important, as far as possible, to avoid the presence of inflammable material in the coaches. He therefore expresses the opinion that it is desirable to substitute electricity for gas for train lighting, and states that he will not in future approve of any rolling stock for rapid transit that is lighted with gas. He also urges the companies, without delay, to arrange for the speedy removal of gas lighting from such trains as are already equipped with it. Exceptions will be made in the case of coaches used for international service and travelling through foreign countries. The catastrophe at Melun showed how necessary was the change, the mail vans on that occasion having been lighted with gas.—*L'Electricien.*

D

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Insurance Companies and Consulting Engineers.

In your issue of 9th inst. appeared a very ridiculous and exaggerated letter under the above heading.

As I am on the engineering staff of one of the leading insurance companies in the country, I would like to put before your readers a few facts in contradiction of "Tyke's" statements.

He has hopelessly mixed up the "Inspector" with the "Canvasser,"—two entirely different positions. The posts of electrical inspectors, when vacant, are open to competition, and the men applying must have a good, practical and theoretical experience (and be able to prove it, too) if they wish to stand a ghost of a chance of securing the job.

As an electrical inspector myself, I would inform "Tyke" that I have served an apprenticeship under agreement for three years with one of the best electrical manufacturers in England, and had a further three years on the test bed, in drawing offices, &c. I have also taken a three years' day course in both mechanical and electrical engineering at the University and taken A.M.I.C.E. Would "Tyke" call this "little or no knowledge of the theory and practice of engineering?"

Also I could mention men on these staffs who are D.Sc., A.M.I.E.E., &c., and quite as capable of giving advice on electrical matters as anyone could wish for.

The "fairy tales" about earthing and burn-outs are very amusing reading, but "Tyke" must not imagine that all the inspectors are as ignorant as this.

It is the canvasser's business to interview prospective customers and quote terms and fees, but these men are not looked upon as engineers, or expected to give advice on technical matters, or do any inspecting or testing. They hold similar positions to the everyday commercial traveller. The engineering and the secretarial staffs are absolutely distinct, a point which is evidently not known to "Tyke."

I could quote numerous instances where the insurance companies have saved pounds sterling for millowners, &c., in pointing out defects and shoddy work put in by contractors, which would otherwise have been taken over in ignorance and paid for.

In conclusion, I would point out that the importance of careful periodical inspection and testing of electrical machines and installations by independent electrical engineers has been recognised by the Institution of Electrical engineers.

I hope to see further letters in support of the above from the various insurance companies to show "Tyke" the errors of his statements.

Facts not Fiction.

January 10th, 1914.

I read with amused interest the letter by "Tyke," and it may naturally be assumed that certain comments therein will meet with a ready response from inspectors who can conscientiously claim to be initiated in engineering practice, befitting their particular duties and requirements.

I must seriously point out an inconsistency in "Tyke's" remarks, viz., "certain insurance companies," followed by a generalisation thus: "the indictment of insurance companies."

His remarks seem to imply that he has had the misfortune to be enlightened upon some scheme, or on a "knotty problem" by one of his "typical examples," without a further verification by a duly qualified "Inspector."

It is gratifying to find "Tyke" emphasising the qualifications, and the source thereof, of his "electrical dubs," for I beg to assert, it is only too true.

"Tyke" may rest assured that the man, who by dealing with engineering correspondence, becomes designated as an inspecting engineer or surveyor, must necessarily have his sphere of usefulness in engineering circles.

Nevertheless, such men may and do create a profound impression upon commercial managers of manufacturing or even engineering concerns. One can well imagine the nature of a discussion between such "types," and, say, a borough engineer.

"Tyke" must admit that there are men, not necessarily engineers, who can discriminate between "bluff" and the real thing.

If "Tyke," in his remarks, wished to imply that electrical installations and electrical plant generally should come under the supervision and examination of "electrical engineers," and not "electrical inquirers," then, I, for one, greatly appreciate his remarks, and cordially invite any suggestions to eliminate the latter from the former.

In conclusion, I trust "Tyke" will eventually meet an "Inspector" in whom he can place his confidence.

Inspector.

The sweeping indictment of insurance companies by "Tyke" in your issue of January 9th should not be allowed to pass unnoticed.

"Tyke's" chief complaint is that "they employ men who have little or no knowledge of the theory and practice of engineering." This cannot, in fairness, be said to apply to the well-known insurance companies which specialise in boiler, engine and electrical work. These companies have an electrical department, and the inspectors employed in this department invariably have had a thorough training in electrical engineering, both theoretically and practically.

One of the outstanding features in insurance work last year was the large amount of electrical machinery which was insured against breakdown. The owners of collieries, shipyards, chemical works, &c., are rapidly realising that it is to their advantage to have their electrical plant insured against breakdown and carefully inspected at regular intervals by a competent engineer.

The reports which they receive serve as a reliable guide as to the condition of the plant, and it is a comparatively rare occurrence for a firm to discontinue insuring after it has had one or two years' experience of it.

Without doubt there are cases where insurance companies undertake work in a consulting capacity, and if a suitable company get this work to do, the result is usually quite satisfactory.

There is one branch of consulting work which an insurance company can undertake as well as, and in many instances more economically to the client than, a consultant could—namely, the examination of second-hand machinery prior to purchase.

Most people realise that to purchase a second-hand dynamo or motor, without having it examined first by an expert, is a very risky procedure.

For example, a man, perhaps in Liverpool, wishes to buy a second-hand electric motor which is in Newcastle. He may not know of a suitable consultant for the work, but, by applying to a reliable engine insurance company, he will get, for a small fee, an inspection made by the company's electrical inspector in that district.

The writer believes that insurance companies have largely helped to popularise electrical machinery, especially in small works where no electrician is employed, and where, unless the plant is regularly inspected, breakdown and dissatisfaction are very likely to occur.

A.M.I.E.E.

Cheap Labour.

I should like the various electrical contractors and employers of labour to note that there seems to be a certain class of employers looking through the advertising columns (situations wanted) of this journal, for somebody *cheap* and good. Well, my experience has taught me that if you want anything good, you generally have to pay a fair price for it. I should think myself that those who receive replies to the above advertisements, asking for fullest particulars, copies of testimonials, &c., upon receipt of same, with an addressed and *stamped* envelope enclosed for return of copies of testimonials, might at least have sufficient courtesy to return

same, even if the amount of remuneration asked for is out of proportion to their intentions, as it is unfair and apparently a waste of time to the advertiser who replies to this class of would-be employer; also, it seems to be a forgotten fact that one who is seeking a berth does not wish to spend money to waste informing this particular class, as even penny stamps and paying for typed copies of testimonials tell up eventually.

One Affected.

The Position of Railway Electrical Staffs.

With reference to "Nemo's" letter regarding the above matter, I can quite sympathise with the writer, but am afraid that this state of affairs is met with only too often. I am employed as charge engineer on the L.C.C. tramways, and am only rated on the temporary staff, although many of us have been "permanently temporary" for nearly 11 years, and there seems no likelihood of our being put on the permanent staff; surely this is liable to create discontent. Not only this, but also we are employed on an average of seven days a week and are compelled to work on Christmas Day, Good Friday, and all Bank Holidays, without getting any extra remuneration or having days off equivalent; moreover, we are constantly on duty throughout the shift, even at meal times. Our responsibilities are great inside and outside the station; for outside, we are held accountable for all traffic delays due to failure of current, owing to cable faults, car faults, foreign metals in conduits, or breakages, &c., of trolley wires. Under these circumstances are we, as well as the railway electrical staff, justified in joining some suitable society to look after our interests?

Can the A.E.S.E. do anything to help us? If so, how?

Omen.

I have no wish to join the Railwaymen's Society, but I think that the attitude of the Metropolitan Railway Co. to its sub-station men is driving them into the eager arms of the National Union of Railwaymen. Dissatisfaction has never been so keen as it is now.

A grievance that I think you might legitimately ventilate, is regarding the class of men engaged as sub-station assistant attendants. Recent additions to the staff include two ex-conductors or porter-guards, a chauffeur, a bank clerk, and one or two nondescripts conspicuous by their lack of education. This type of man we are expected to train into efficient sub-station attendants. As well try to turn a sow's ear into a silk purse.

It seems hardly fair to men who have served their time and paid for their training—before serving the "Met." four years to attain the dizzy height of 40s. to 45s. a week of 56 hours and seven days' leave annually as charge engineers—to become kindergarten instructors gratis. Why, it takes all one's time seeing that an "assistant" of that type does not kill himself or blow the plant up. At the risk of being called a snob, I must say that it is hard to spend a third of one's life in the society of a boor, with no means of escape.

The inevitable consequence of having these incompetent men about the job is—bang, two coffins—or two new rotary converters.

Idoneus Homo.

Proposed Higher London University Training.

The able, and no doubt well-meant, article by Mr. G. E. Mappin in your issue of January 2nd has induced me to write this letter.

I am sadly of opinion that Mr. Mappin can have very little knowledge of how the young men who are trained at colleges of the London University and at other institutions throughout the country are treated by the municipal and other employers of the proud country which is supposed to be setting a pattern to every other nation on the earth for fair and square dealings between man and man.

If Mr. Mappin will turn over a few leaves next to the page on which his letter appears in the REVIEW, he will see what I mean; he will read there of the "high" value which the Corporation of Reigate consider the services of an electrical engineer to be worth, the sum being 28s. for eight hours' work on every day of the week—Sundays, of course, included—but not a word is said about overtime and the long hours spent on inside and outside breakdown work, and the double shifts that have to be worked to make up for the extra time that one engineer slaves through long hours of nerve-breaking monotony in order that his friend may have a week-end off to spend at his home, which, in many cases, is a long train journey off.

But the miserable heart-breaking allowance offered by the Reigate Council for the services of an experienced shift engineer is only one case out of scores which appear in the ELECTRICAL REVIEW and other papers. In fact, only a short time ago a shift engineer with qualifications was advertised for in the ELECTRICAL REVIEW by a borough works in one of the largest towns in Kent, and the wage that is paid to the street sweepers of the town was considered enough to offer to the educated and trained electrical engineer, namely, 25s.

To talk of a higher standard of training and examinations where there are no prospects to follow, except for a few, will be considered as absolute nonsense and mockery by the parents, some of whom have spent the savings of their lives on fees and premiums.

I am only one of the many parents who have made themselves very poor in order that their sons should be well educated and properly trained to fill a post in some profession or occupation in which qualifications should count for something, but is it likely, when it becomes more generally known, that parents will be so foolish any longer as to send their sons to the colleges of the London University, or to any other institution, and into the workshops of engineering firms who demand heavy premiums, to have them trained to follow the most miserable and worst paid of all the occupations in this country at the present time?

The chief engineers are in almost every case to blame for the low wages paid, which they know very well neither they nor the employers would dare to offer to a carter belonging to a Trade Union.

It is rank treachery for a chief engineer who, in most cases, draws good money himself, to let his fellow assistant engineers be taken advantage of by municipal and company employers, because as chief he knows that his assistants have no society to protect them, and are hopelessly at the mercy of himself and the employers. The naked truth is that in nearly every case the chief "sweats" his fellow assistants for the purpose of gaining credit for himself for economical management.

I have not heard that the Institution of Electrical Engineers, which is not above taking a yearly subscription from a 25s. a week man, has ever moved head, hand or foot to protect its members.

I sincerely hope that the indefatigable secretary (Mr. Ebben) of the A.E.S.E. will succeed in getting every electrical engineer in the country and every power-station man to join the newly-formed league without any further hesitation or delay.

I happen to know that a short time ago, in answer to an advertisement for a charge engineer at a weekly salary of £2 15s., which appeared in the ELECTRICAL REVIEW, there were 400 applicants. I consider myself that no fairly well-trained man who is employed as a shift or charge hand at any station where there is a large voltage generated, or where the plant to be supervised is considerable, should be paid less than £3 per week.

Interested.

[We have been obliged to abbreviate this letter.—EDS. ELEC. REV.]

"Rodolite" Heating Elements.

We note in your issue of January 2nd a letter from Messrs. Bastian Electric Heating Co., which appears, although our firm is not mentioned in any way, to be a reply to our letter contained in your issue of 26th ult. We must say at once that we have no desire to enter into any controversy with your correspondents. What we are particularly interested in is their introduction as "new" of a heating element styled "Rodolite," the published description of which, together with the illustration of the same in your issue of 19th ult., corresponds with that of a heating element we have now been making for some years. This element is

made in precisely the manner referred to in the ELECTRICAL REVIEW, October 6th, 1911, page 543, and the *Journal* of the Iron and Steel Institute, June, 1908, viz., "a thin-walled tube of quartz, wound on its outer surface with coil of resistant wire." This construction is so simple that no misapprehension can possibly exist in understand it; we have, however, forwarded a sample element to the Editor for his inspection. We beg to assure your correspondents that this heating element is not an experiment, either "interesting" or otherwise; it is, in fact, an old and well-tried device which is common property, and as such is employed by some of the most celebrated makers of electrical heating apparatus throughout the world, although the Bastian Electric Heating Co. are apparently not aware of this fact, as they refer to it as the product of some "unknown maker."

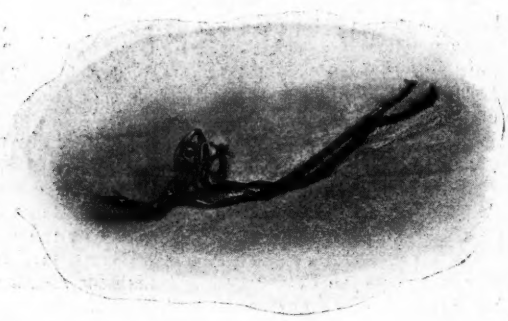
The only possible modification in the construction that we can assume, would be in the form of the terminals for attaching the resistant wire, but this would not constitute a "new heating element," which your readers will note is the claim made by your correspondents.

Standard Electrical Heating Co.

Newcastle-on-Tyne, *January 6th*, 1914.

What Happened to a Frog.

I enclose herewith a photograph of a frog after it received 10,000 volts from our H.T. line. This frog had evidently dropped from a tree and made connection with the H.T. line and an iron guard which encircles the insulation. The



peculiarity is that it remained in circuit, thus grounding the line, and the plant had to be shut down until the fault was localised.

Chas. Udall,
Chief Engineer and Manager, the Nairobi Electric Power and Lighting Co., Ltd.

Nairobi, B.E.A., *December 17th*, 1913.

American Methods.

I have read the flattering criticism of myself and my article by "English," and note his euphemistic pronouncement:—"He does not write the truth!" After this it is not to be wondered at that he should sum me up as being probably "a man of very narrow experience"—mainly on the ground, I suppose, that my ideas do not coincide with his own.

Whether we believe the quality of self-assertiveness to be essentially good or bad, it is certain that in its acute form it is inimical to true co-operation, that is, co-operation not directly stimulated by one's material interests—and, for that matter, to competition also. Its inevitable outcome is a system of monopoly, and your correspondent (evidently realising this) attempts to show that monopoly is not an evil. Really it is the abuse of monopoly that is bad; but, human nature being what it is, it is better not to permit unrestricted monopolies at any rate until men are found who are fit to hold them. It is hard to reconcile the idea that American methods are in any sense co-operative, with the relentless intolerance of competitors—particularly less powerful competitors—usually shown by concerns run on American lines. There are, however, many instances where there is practically no alternative to some form of co-operation, as, for examples, supply companies or authorities having clearly-defined areas of supply which do not overlap, companies whose share capital is held or controlled by the same financial group, and rival concerns whose organisations and financial resources are so nearly matched as to make a fight for the monopoly dangerous for both. To cite such as these as proof that co-operation really has a place in American methods is to beg the question. Your correspondent says that he is "called upon almost every day to co-operate with others, and not exactly for the sake of the mere dollar or two there may be in it," but as he claims to be not an American, what he does or does not do is not evidence, so far as the present discussion is concerned.

His statement that "most American enterprises do pay a dividend" may or may not be a precise statement of fact, though I am inclined to doubt it. A point of greater importance than this is the amount of the average dividends paid during the lives of the companies of which he writes. Again, what is to be said about the wastefulness of American methods—the enterprises crushed out of existence in the relentless elimination of small competitors by the larger concerns? These points should all be considered in weighing up the net result of American methods.

I did not "deliberately misinterpret Mr. Seabrook's remarks," nor did I overlook any of the features of "welfare work" which your correspondent mentions. What I emphasised was that for a man's real welfare his first and greatest need is the consciousness of liberty. To attempt to increase his efficiency by "welfare work," as outlined by "English," whilst expecting him to have the spirit of a slave—meting out to him "different treatment to what those at home might deem desirable or necessary," may be good American practice, but is not likely to prove satisfactory in the long run.

Your correspondent's reference to Mexico is not a particularly happy one, for it would be strange if, with its geographical and political advantages, the United States could not secure the larger share of the trade with that country.

In the concluding part of his letter, "English" incidentally gives us a look through his perspective. His conception of the manufacturers of the United States setting the pace in their methods to the whole world, is, truly, a wonderful picture. His last sentence is a confession of such an abandoned and unquestioning belief in the pre-eminent excellence of American methods, that one feels impelled to stand aside in wonderment, and let it pass for what it is worth.

F. W. D.

January 12th, 1914.

A Peculiar Lightning Stroke.

The case reported in your issue of 9th inst. would be the most remarkable on record if the occurrence was as your Norwegian correspondent suggests; but before condemning this flash as having acted in defiance of the laws of Nature, we ought to make sure that it is the lightning, and not the deduction of the observer, that is at fault. Several explanations suggest themselves, but the details given do not allow one to select the most probable. It would be of interest, and, perhaps, throw more light on the matter, if your correspondent would give the following additional information:—

1. What reason has he for stating that the flash left the conductor and sparked across (presumably through the air) to the zinc roof nearly 30 ft. away?
2. What is the total length of the building with the zinc roof?
3. Height of the highest part of this roof above eaves?
4. Nature of damage to brickwork at chimney top and to cable?
5. Diameter of chimney top, and how much of the 8-ft. rod projected above it?

I have read of other alleged effects of lightning as unorthodox as this, but found them, on investigation, to be simple and quite in accordance with law, and I am not prepared to abandon the axiom that effect is due to cause without very definite evidence.

Alfred Hands.

London, E.C., *January 13th*, 1914.

The Continuity of Supply.

That the North Metropolitan Electric Power Co. think it necessary to secure the insertion of a clause in their Bill prohibiting strikes of their employés, is an education in itself.

Why has no attempt been made before to insert such a clause in electric supply Bills? The answer is simple; the station men were unorganised. At the first whisper of a station engineers' organisation the company fly to the law for protection; it certainly seems as though they had something to fear, which in itself is a compliment to any organisation to which their employés may belong, and emphasises the fact that the conditions of employment are not what they might be.

Perhaps this effort of the North Metropolitan Co. is just a trial on behalf of the 100 or more companies who are members of the British Electrical Federation, Ltd., which represents capital of about £13,000,000 and 10,000 employés, so that the ultimate result may be widespread should the company be successful in their application. Whether the insertion of this penalty clause in electric supply Bills will prevent strikes of the employés in stations is a question of the future, but it is a fact that the temper of the employés of most of the power companies has been anything but docile during the last 12 months. The power companies generally pay very low wages, especially in the sub-stations, and in one or two cases they exact an agreement for one or two years' service with the company, in conjunction with the payment of rates varying from 15s. to 25s. per week of seven days, the company reserving the right to dismiss any employé under these agreements at one month's notice. The majority of the employés of power companies, and also of a few municipal authorities, have a deep impression that their services would be dispensed with should it become known that they had joined an organisation to increase salaries.

No doubt after the direct reference to the "recently formed association of station engineers," with a "militant policy" in conjunction with the strike penalty clause in last week's issue of the REVIEW under the above heading, station engineers will naturally ask: Will such a clause affect the A.E.S.E.?

Up to the present the A.E.S.E. has used peaceful measures to better conditions in electrical stations, except that in one or two instances (which may be described as semi-peaceful) the whole of the running staff handed in their resignations in the legitimate manner and were quite prepared to find other positions, but this was not necessary, as the supply authorities in question found a great difficulty in finding men to replace those who had resigned, even though a larger salary was offered than that they had previously been paying. The conditions were bettered, and the majority of the men withdrew their resignations.

From this the conclusion is obvious as to the effect of the clause in question on members of the A.E.S.E., although it remains to be seen whether it will be advantageous to oppose the clause, so that Parliamentary Committees and others may get some insight into the conditions of hours and wages of those whom this clause will endeavour to penalise (as suggested in the article last week).

Station men are now determined to obtain a 6-day week of employment and reasonable wages for their services, by peaceful means if possible, but failing peaceful means nobody can deny that station men would be fully justified in using other methods to remedy the discreditable conditions that prevail in the generating and sub-stations of Great Britain to-day as regards wages and hours worked.

In conclusion, I must state that the majority of station engineers acknowledge that they have a great duty to the community, and at the same time insist that the community have a duty to them to see that they receive wages comparable with a station engineer's great responsibility, and a weekly rest day. The community generally have to be inconvenienced before they realise any duty, but this inconvenience can be prevented by a reasonable attitude on the part of the "powers that be."

W. J. Ebben,

Hon. Sec., Association of Electrical Station Engineers.

London, E., *January 13th*, 1914.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

B.T.H. Sewing-Machine Motors.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby, has put on the market a line of small sewing-machine motors for domestic use, suitable for the needs of unskilled persons. We illustrate in fig. 1 a motor of type D S S, form K C, as applied to a sewing machine. The power required is about 45 watts D.C., or 55 watts A.C. Several patterns are made, to suit various makes of

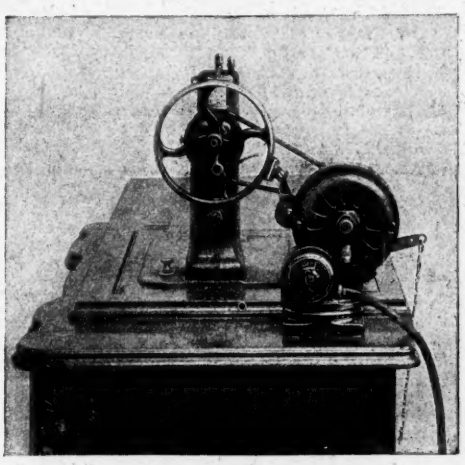


FIG. 1.—B.T.H. SEWING-MACHINE MOTOR.

sewing machine, but as a rule forms K and K C, which are built for D.C. and A.C. respectively, are applicable to almost all styles of family machine. Each motor is fitted with a belt-tightener and brake, and the control is effected by means of a connection to the treadle, which releases the brake and tightens the belt, or *vice versâ*. A rheostat is not used to regulate the speed, the motor running all the time at full speed.

Automobile Lighting Switchboard.

MESSRS. A. P. LUNDBERG & SONS, of 477, Liverpool Road, N., have standardised two patterns of switchboard for motor-car lighting and similar purposes, of which one of the chief features is compactness, six switches being got into an overall width of 6 in. Fuses with spring-clip fuse-holders are provided, and an ammeter and voltmeter are mounted on the sloped top of the case,

FIG. 2.—LUNDBERG AUTOMOBILE LIGHTING SWITCHBOARD.

with a "Pixy" push-button in circuit with the voltmeter. A plug connection is provided at the side for a portable hand-lamp. As shown in fig. 2, the lower half of the front forms a hinged lid to afford access to the fuses and terminals. The cases are of mahogany or aluminium. Other types of switchboard are also made.

Land's Screw-Cutter and Automatic Die.

An attachment has been devised by MR. HENRY S. LAND, of 8, Park View, Old Road, Lee, S.E., by which an ordinary engineer's lathe can be immediately converted into a highly efficient machine for making bright engineers' bolts, studs and other repetition work rapidly and of high-class finish.

The attachment supplied without the cradle H, can be immediately fitted to a capstan lathe and perform all its operations without any turning movements or rotation of the turret, thus enabling, for example, a light capstan for brass work to turn out large steel bolts, screws, &c., from the bar.

The device, as fitted to the back headstock of an ordinary engineer's lathe, is shown in figs. 3 and 4.

The centralising shank B is turned taper to fit the taper hole in the headstock mandril to ensure accurate alignment, while the phosphor bronze clamps A being bolted to the outside periphery of the mandril, take the whole of the working stress and in conjunction with the stay rods support all overhang.

In fig. 3 the screwing die head is shown swung up clear of the hexagonal or other section rod, from which the turned bolts are made. In the centre of head of turning box, marked Z, is a large ball-bearing ring, into which steady bushes are fitted corresponding to the shape of rod being operated upon; this is for the express purpose of supporting the end of rod preparatory to the cutting operation of the tools.

This arrangement of a central revolvable steady in lieu of the old fixed back V or roller steady not only furnishes an absolute central support for the end of the rod prior to the cutter's starting operation, but enables the use of both back and front cutters; consequently the tools retain a keen edge for weeks without grinding owing to the cutting duty of the tools being halved.

The cutters are mounted in axially adjustable boxes, three on each side, which slide transversely to the turning box on T rails. For each diameter two tools are used, one back and one front, so

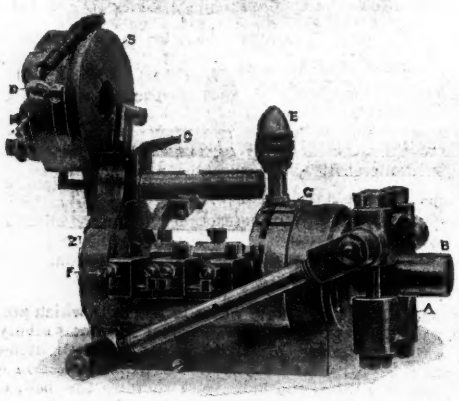


FIG. 3.—SCREW CUTTING AND DIE ATTACHMENT, DIE HEAD SWUNG CLEAR.

that the work is practically free from up thrust during the whole operation of turning, the depth of cut being regulated by the thrust collar screws marked F, fig. 3.

The T rails are provided with pins which fit slots in a cam plate recessed in the bottom of the turning box, and by the rotation of this cam plate, which is actuated by the movement of the milled lever E into one of the notches cut in the rack G, the whole of the tools can be simultaneously fed in or out, thus permitting a number of different diameters to be cut without any resetting of tools.

In fig. 4 the die head S is swung down into the working position by pressing the trigger marked C, which secures it when raised clear of the work, as seen in fig. 3, and also when the die

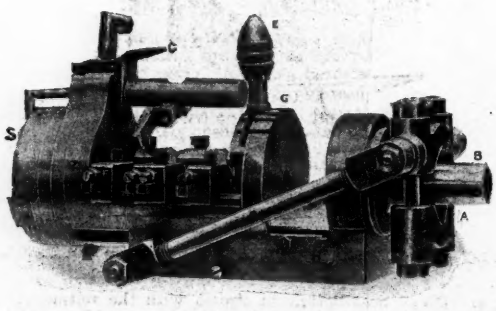


FIG. 4.—SCREW CUTTING ATTACHMENT, DIE HEAD IN POSITION.

head is lowered for screwing. The view shows how the die head is free to slide during the screwing operation.

The automatic trip motion in the die head is arranged so that a roughing and a finishing cut on any thread can be taken if required by pulling handle marked D, fig. 3, on to the first or second stop, the dies immediately opening when the predetermined length of screwing is reached in either case.

Electrostatic Safety Valve.

For the protection of low-voltage transformer circuits and telephone lines against high pressure, and for use in series lamp circuits, &c., Prof. Steels has designed the "electrostatic safety valve," illustrated in the accompanying sketch. Two screwed metal electrodes B_1 B_2 form a condenser with air dielectric. The distance apart of these blocks and of the pointed and screwed core-rods with which they are provided, can be adjusted with such accuracy that the valve can be employed satisfactorily for pressures

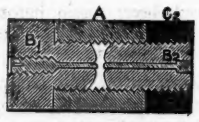


FIG. 5.—ELECTROSTATIC SAFETY VALVE.

as low as 15 volts. The space between the electrodes is hermetically enclosed by the ring A; directly the ionisation of the air in this space reaches a certain degree, spark discharge occurs and the current circuit is short-circuited.—*Revue Electrique.*

Varta Ignition Batteries.

THE BRAULIK ENGINEERING CO., of 8, Lambeth Hill, Queen Victoria Street, London, E.C., has lately put on the market the "Varta" ignition batteries, which can be conveyed in the car in a charged but unfilled condition. In case of emergency these cells, when filled with sulphuric acid of sp. gr. 1·26, are ready for immediate use. At the first discharge the batteries possess 80 per cent. to 90 per cent. of their guaranteed capacity. They can be stored for any period in an unfilled condition until required, provided that they are kept in a dry place. If practicable, a small charge of the newly-filled battery is advisable before putting into operation for the first time, or at least the duration of operation should be curtailed as much as possible.

The Varta batteries are provided with pasted plates consisting of cakes of active material, and possessing a considerably longer life

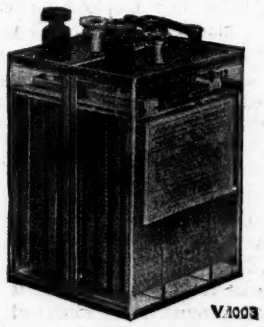


FIG. 6.—VARTA IGNITION BATTERY.

than grid plates. The plates are rigidly mounted in a celluloid box, and separated from each other by means of ebonite separators, so that a short circuit is almost impossible, notwithstanding the position of the accumulator. The lugs and noses are substantially designed in order to resist shocks. The cells are immovably mounted in sheet-iron or wooden battery cases, thus preventing the pole connections from becoming damaged.

The Reception of Radio-Signals.—Experiments were recently conducted by H. Mosler between Norddeich and a receiving station 263 miles to the east of the latter. The strength of the received signals was investigated by aid of a reflecting galvanometer and also by paralleling the receiving telephone with a variable resistance, the latter being adjusted till signals became inaudible. An umbrella aerial 60 ft. high was used for reception, a copper pyrites detector, block condenser, and galvanometer being used in an aperiodic circuit. Observations taken six or eight times a month throughout a year showed that by day no considerable energy variations occurred; the loudness of reception did not appear to depend on the altitude of the sun. In spring and autumn, however, reception was twice as powerful by night as by day, whereas the distinction was much less marked in summer. Atmospheric pressure, humidity, temperature and wind velocity appeared to have no influence on reception, but on cold, starlight nights, the intensity of signals would frequently vary over a range of 6 or 8 to 1 within a few minutes, and according to no regular rule. Nights on which reception was loud but variable were often followed by nights on which reception was normal. Moonlight seemed to have no effect on reception. Similar results were reached using a horizontal earth antenna. In the author's opinion, the variations observed were due to variations in the conductivity and reflecting powers of the upper ionised layers of atmosphere (layers which, according to Heaviside's theory, are at a height of 30 to 60 miles). This would agree with Taylor's observation that night reception is, in these regions, most powerful during spring and autumn when the aurora borealis is most active.

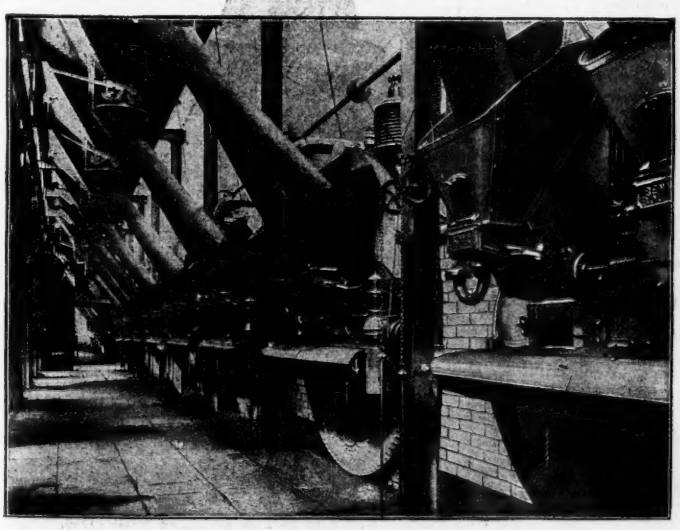
MACHINE FIRING AT FORMBY POWER STATION.

THIS generating plant, which supplies the L. & Y. Rly. Co.'s electrified lines in the Liverpool-Southport area, is equipped with 16 32 ft. 6 in. × 8 ft. 6 in. Lancashire boilers, each with a normal evaporation of 12,000 lb. per hour. Superheaters and economisers are fitted and two 100-H.P. induced draught fans. Recently the whole of these boilers have been equipped with Bennis machine stokers. The order for the first eight "Sprinkler" stokers and self-cleaning compressed-air furnaces was placed under severe guarantees; any or all of the boilers were to be capable of evaporating 14,000 lb. of water per hour for 24 hours on end or 16,000 lb. for short intervals, all the power for boiler auxiliaries being deducted before the evaporation was recognised. The guarantees were more than fulfilled, and Messrs. Bennis were instructed to equip the remaining eight boilers, which with the earlier stokers have been fitted with the double shovel arm gear. The results of the boiler tests, which were witnessed by representatives of both the L. and Y. Rly. Co. and Messrs. Bennis, were as follows:—

3-HOUR TEST.

Duration of test	3 hours
Number of boilers	3
Draught in in. of water-gauge in main flue	1·37 in.
" " " at chimney base	1·75 in.
Percentage of CO_2 in flue gases leaving boiler	12·8
Temperature of feed-water—	
Entering economiser	63·0° F.
Entering boiler	252·0° F.
Steam pressure by gauge	160·0 lb.
Superheat	171·49° F.
Factor of equivalent evaporation as from, and at, 212° F., including economiser ...	1·3027
Coal used...	White Moss (ordinary firing slack)
Total weight of coal burnt	22,960 lb.
Coal burnt per boiler per hour	2,551 lb.
Coal burnt per sq. ft. grate surface per hour	56·69 lb.
Total quantity of water evaporated	161,131 lb.
Water evaporated per boiler per hour ...	17,903 lb.
Water evaporated per lb. of coal	7·02 lb.
Total equivalent evaporation, lb. 209,904	178,208*
Equivalent evaporation per boiler per hour lb. 23,323	19,801*
Equivalent evaporation per lb. of coal lb. 9·14	7·76*

* Not including economiser.



BENNIS MACHINE STOKERS, FORMBY POWER STATION.

8-HOUR TEST.

Duration of test	8 hours
Number of boilers	8
Draft in inches of water-gauge—downtake ...	·31 in.
Percentage of CO_2 in flue gases—at downtake	15·5
Temperature of feed-water—	
Entering economiser	52·8° F.
Entering boiler	196·4° F.
Steam pressure by gauge	155·75 lb. per sq. in.
Superheat	135·17° F.
Factor of equivalent evaporation as from, and at, 212° F., including economiser and superheater	1·2920
Coal	White Moss (ordinary firing slack)
Cal. value of per lb. (dry)	13,208·9 B.TH.U.
Total weight of coal burnt	88,244 lb.
Dry coal burnt per boiler per hour	1,292·8 lb.
Dry coal burnt per sq. ft. grate surface per hour...	26·73 lb.
Total quantity of water evaporated	673,454 lb.*
Water evaporated per boiler per hour ...	10,723·8 lb.
Water evaporated per lb. of dry coal ...	8·295 lb.
Total equivalent evaporation...	886,710 lb.
Equivalent evaporation per boiler per hour ...	13,854·8 lb.
Equivalent evaporation per sq. ft. boiler heating surface per hour	11·54 lb.
Equivalent evaporation per lb. of dry coal ...	10·117
Total thermal efficiency obtained	81·103 per cent.

* After deductions are made—gauge glass corrections, steam jets, power for stoker.

PHYSICAL SOCIETY EXHIBITION.

(*Concluded from page 52.*)

FOSTER INSTRUMENT CO.

A NEW pattern of the fixed-focus radiation pyrometer was shown, which can be used, by a simple conversion, either for molten metal (by means of a tube of refractory material with a closed end), or for "black body" furnace work with an open end. The Hoskins alloy thermo-couple pyrometer was another useful device, intended for the direct immersion of the thermo-couple in molten brass or bronze. The nickel-chromium alloys used are of a highly refractory and non-alloying nature, so that the thermo-couple tip deteriorates only very slowly. The instrument is convenient for the rapid measurement of temperature before pouring, and is applicable to metals whose radiating surface is not suitable for use with the ordinary radiation pyrometer. Various other thermo-couple pyrometers using these alloys were shown, as well as a pyrometer alarm attachment which lights a lamp or rings a bell whenever the temperature (which is also recorded on a chart) passes any predetermined limit.

H. TINSLEY & CO.

The chief features of this exhibit were mainly of optical interest, but a collection of Dr. Drysdale's A.C. potentiometers, wattmeters, &c., was shown. The A.C. potentiometer, which combines in itself almost a complete laboratory equipment, has been brought up to a remarkably high pitch of accuracy, and is now in use in some of the remotest quarters of the globe.

RECORD ELECTRICAL CO., LTD.

The Record patent "Cirscale" instruments, with scales subtending an angle of 300°, were shown, including a pattern with the dial

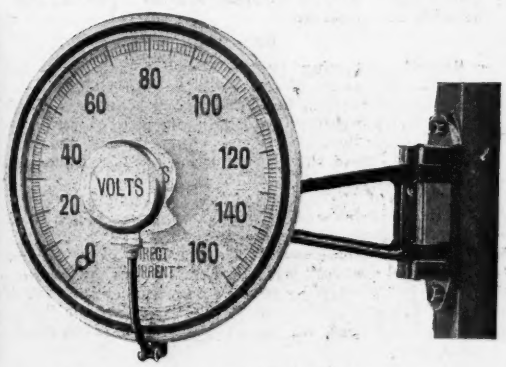


FIG. 15.—FRONT ILLUMINATED VOLTMETER.

FIG. 16—LABORATORY MILLIVOLTMETER.

illuminated from the front, as shown in fig. 15, the effect obtained being very satisfactory. Another novelty was a laboratory substandard with horizontal dial, reading in millivolts (fig. 16).

WESTON ELECTRICAL INSTRUMENT CO.

The Weston stand was a very attractive one, all kinds of the company's instruments being shown, including a number of fre-

quency, power factor and wattmeters in operation with a synchroscope, illustrating the process of synchronising with the supply current from the mains. The new miniature precision direct-current instruments, which we recently described, were shown in great variety, and attracted much attention, their handsome design and finish being worthy of their qualities as accurate measuring instruments.

MARCONI'S WIRELESS TELEGRAPH CO., LTD.

The Marconi crystal receiver (Type No. 16) was shown, which combines in one case an aerial tuning inductance and condenser, coupled to a detector circuit consisting of a variable condenser and an inductance. The detector consists of two carborundum crystals, which can either be used independently or put in opposition, the latter arrangement having the advantage that the effect of strong atmospherics is greatly reduced whilst the received signals are

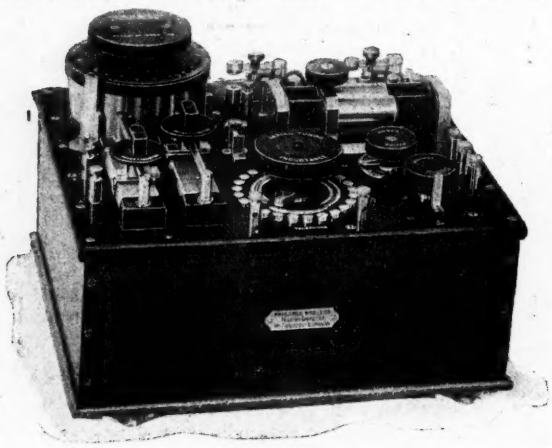


FIG. 17.—CRYSTAL RECEIVER, TYPE NO. 16.

practically unaltered. A telephone transformer with tuning condensers is provided. The instrument is suitable for wave-lengths from 250 to 3,800 m. Another crystal receiver, for use in conjunction with the multiple tuner, and a direction finder were exhibited, as well as an adjustable air condenser of new pattern, designed to give the largest possible capacity in a given space, whilst leaving sufficient gap between the plates to allow a pressure of 500 volts to be safely used with it.

DEMONSTRATIONS.

Several interesting processes and apparatus were shown by private exhibitors. Messrs. C. C. Paterson and B. P. Dudding, of the National Physical Laboratory, gave a demonstration of a new device for mitigating the dazzle caused by motor-car headlights, by preventing the emission of any light from the lantern to the right-hand side of the road above the horizontal plane. Full light is given over the rest of the area, amply sufficing for all the requirements of the motorist, while drivers or pedestrians meeting the car, on their own side of the road, are protected from "dazzle," but are clearly visible to the motorist.

Prof. J. T. Morris showed a simple, but effective, apparatus for measuring the pull on a conductor carrying a current in a magnetic field—the design of Mr. L. Murphy. Prof. Morris and Mr. J. F. Forrest also demonstrated the use of the electric arc as a standard of light, on the lines described in our issue of October 24th, 1913.

THE HALF-WATT LAMP.

A VERY important development in incandescent electric lamp manufacture was announced by the BRITISH THOMSON-HOUSTON CO., LTD., towards the end of last August. This announcement referred to the "half-watt" Mazda tungsten lamp, which was then exhibited for the first time in this country, at the company's London branch offices. An account of the demonstration and a description of the new lamp were published in our issue of August 29th.

Naturally great interest was aroused in this new development, and inquiries have rained upon the makers as to when the new lamps would be available. We are now informed that the manufacture of these lamps has been standardised at the B.T.-H. Co.'s Rugby factory, and delivery can be effected to order.

The lamps give two candles per watt, and have an average useful life of 800 to 1,000 hours; the light is much whiter than that of the ordinary tungsten lamp, approximating to daylight, and the intrinsic brilliancy of the filaments is eight times that of the ordinary type, so that for interior lighting it is essential that the lamp be enclosed in suitable diffusing glassware.

The sizes and voltages for which the lamp is available are as follows:—

Volts.	Watts.	Approx. British c.p.
50-65	300 and 500	600 and 1,000
100-130	500, 1,000, 1,500	1,000, 2,000, 3,000
200-260	1,000 and 1,500	2,000 and 3,000

As we have already explained, the bulb of the lamp is filled with an inert gas, such as nitrogen, and the filament is wound in a close spiral and mounted in short loops, making a very different construction from that to which we have become accustomed; the reasons for this procedure were fully explained in the papers by

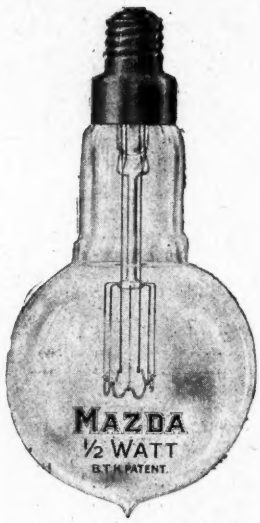


FIG. 1.—MAZDA HALF-WATT LAMP.

Messrs. Langmuir and Orange, which we abstracted in our issues of October 31st and November 7th, 1913. Both the drawn-wire filament and the half-watt lamp originated with the makers of the Mazda lamps, which are now available in all sizes from 1 to 3,000 c.p. The B.T.H. Co. have also developed a range of special fittings

FIG. 2.—SPECIAL WEATHERPROOF FITTING FOR USE WITH MAZDA HALF-WATT LAMPS FOR OUTSIDE LIGHTING.

for use with the half-watt lamp, including weatherproof lanterns for the lighting of streets, open spaces and shop fronts, fitted with reflectors and opalescent globes, as well as indoor fittings equipped with their Alba and Veluria glassware. Full particulars are given in the B.T.H. Co.'s price list No. 11,000.

Needless to say, the new lamp lends itself admirably to indirect and semi-indirect illumination, of which the company has made a special study, and fittings for these purposes are available.

The GENERAL ELECTRIC CO., LTD., have sent us particulars of their half-watt Osram lamps, one of which is illustrated in fig. 3. We understand that information regarding actual installations of these lamps will shortly be available. It will be seen that the construction of the lamp differs in detail from that above described, but in the main the same description applies. An average burning life of 1,000 hours is claimed, during which period the candle-power is almost constant. The ratio of mean spherical to maximum horizontal candle-power is given as 85 per cent., and the concentration of the filament makes it easy to design reflectors to give any required distribution of light. The filament is in one continuous length, and is stronger than that of the ordinary

tungsten lamp. The bulb, on the other hand, is considerably smaller than that of an ordinary lamp of the same wattage, but owing to its special shape there is hardly any loss of candle-power

Fig. 3.—Osram Half-watt Lamp.

due to discoloration, the deposit being carried up by convection current and deposited on the upper portion of the glass.

The "Nitra" half-watt lamp is being introduced by the Electrical Co., Ltd.; it is illustrated in fig. 4, and here again small differences in construction will be noticed. In particular, we may draw attention to the absence of the tip, which is liable to accidental breakage, and to the mechanical method of fixing the socket to the bulb, which renders loosening impossible. Special patent fittings have been devised by the makers to suit the "Nitra" lamp, one of which is shown in fig. 5.

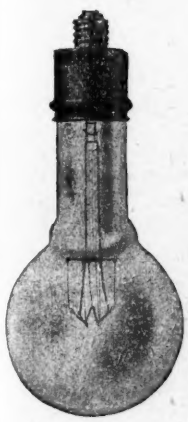


Fig. 4.—Nitra Half-Watt Lamp.

Fig. 5.—Nitra Lamp with Outdoor Fitting and Reflector and Opal Globe.

The "Nitra" lamp has been in commercial use in Berlin for several months with satisfactory results.

The Edison-Swan Co. are placing on the market the Royal Ediswan half-watt lamp, in sizes which include, in addition to those mentioned above, 1,000 and 1,500 watts at 50-65 volts. Special lantern fittings, with reflectors and globes for outdoor lighting, have been designed for use with the new lamp.

Messrs. Siemens Brothers Dynamo Works, Ltd., have brought out the "Wotan" drawn-wire half-watt lamp, which, with some differences in detail, is made on the same lines as the foregoing, and in the same sizes. It may be observed that the Edison screw cap is always used with the half-watt lamp. Weatherproof lanterns and street lighting fittings have also been devised by Messrs. Siemens Brothers, in various patterns.

The era of the half-watt lamps has thus commenced, and we anticipate that the demand for them will tax the utmost resources of the various makers.

Congresses in 1914.—The *Morning Post* has issued a large wall card giving particulars of congresses of learned societies and other bodies that are expected to take place during 1914, 1915 and 1916, and in some cases even down to 1920.

LEGAL.

James Howden & Co., Ltd., *v.* Powell Duffryn Steam Coal Co., Ltd.

In the Court of Session, Edinburgh, Lord Hunter had before him this claim for payment of the balance of the price said to be due to the pursuers by the defenders under two contracts between the parties. Under these contracts the pursuers agreed to supply and erect certain plant at the defenders' electric power station at Aberaman, South Wales. The first contract was dated July 6th, 1907, and the second, which was substantially a duplicate of the first, was dated February 23rd, 1909. The engineer appointed under the contracts rejected a turbine under each of the contracts. The pursuers said the turbines so rejected were conform to contract, and that the engineer was not justified in rejecting them. Two years ago Lord Hunter sisted procedure in order that the matters in dispute might be settled by arbitration. On Thursday last week, on the motion of counsel for pursuers, his Lordship assoilzied the defenders and found no expenses due to or by either party in terms of a joint minute.

A Scarborough Vibration Claim.

At Scarborough County Court last Tuesday the Misses Malenda and Mary Ross, confectioners, of Filey, sued J. E. Winter, tobacconist and hairdresser, for £50 damages and an injunction in respect of the noise and vibration caused by an engine and dynamo used for generating electricity for the hairdressing business. It was alleged that for the fixing of the dynamo the course of bricks on the defendant's side of the dividing wall between the two shops had been removed, and thus there was only a thickness of 4½ in. of brick between the dynamo and the plaintiffs' living room. The case was fought out at great length and adjourned.

THE TATA HYDRO-ELECTRIC SCHEME.

From time to time we have noted in our pages the progress made in the carrying out of the Tata hydro-electric scheme, which will eventually provide some 100,000 H.P. for transmission to the City of Bombay, where many of the 83 cotton mills are being equipped for electric driving.

The annual report of the Tata Hydro-Electric Power Supply Co., just published, shows that if the pipe line can be completed it will be possible to commence generating and transmitting power to Bombay next month, all sections of the work except the pipe line being well advanced, including structural work at the mills which are being electrically equipped. In view of the near approach of the operating stage, we append a short description of the undertaking, based on particulars which were recently given in the *Electrical World*, to which we are indebted also for our illustrations.

The storage lakes and hydraulic works of the Tata development are near Lonawla, a hill station at the summit of the Bhor Ghat, on the coast range. The precipitation in this area averages some 200 in. annually and is stored in lakes formed by constructing masonry dams across the Lonawla, Walwhan and Shirawta valleys as shown on the map, fig. 1. This water will be used in a power plant some 2,000 ft. below, the rainfall being used direct during monsoon periods.

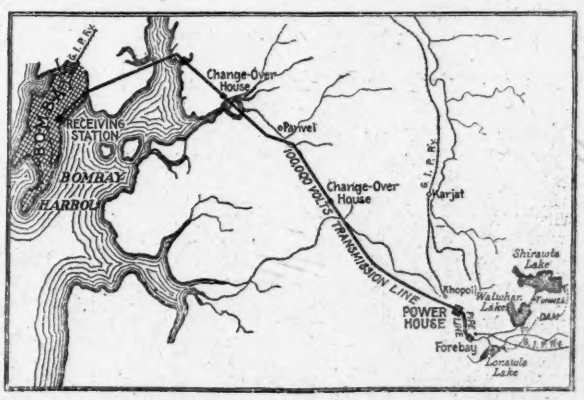


Fig. 1.—Water Storage and Transmission Line, Tata Hydro-Electric Scheme.

The Lonawla lake has a sufficient capacity to cover the largest break of monsoon on record; it is formed with two dams 3,600 ft. and 1,900 ft. long respectively, enclosing an area of 986 acres, and a total capacity of 466 million cub. ft. of water in the 19 ft. range between full supply and outlet levels.

For the remainder of the year the other two lakes will be

drawn on, viz., the Walwhan, with a dam 4,500 ft. long, enclosing an area of 1,535 acres with a total capacity of 2,560 million cb. ft. between outlet and full levels, and the Shirawata, with a dam 8,000 ft. long, enclosing 3,174 acres and a total of over 7,000 million cub. ft. of water.

The latter lake will be connected with Walwhan by a 5,000 ft. tunnel, and from Walwhan a masonry duct, 4 miles long, leads to the forebay on the edge of the Ghats, being joined en route by the duct from Lonawla lake.

From the forebay the pipe line runs some 13,000 ft. to the power house, giving a static head of 1,727 ft., corresponding to 743 lb. per sq. in. at the turbine. The pipe line is in two sections, the upper portion, 8,200 ft., consisting of two pipes each of a diameter ranging from 82 in. at the top to 77 in. at the bottom, where they each enter a 72 in. dia. distributing pipe; each distributing pipe feeds four pipes forming the lower 4,800 ft. of pipe line. These pipes vary from 42 in. to 38 in. diam.

The pipes are of Siemens-Martin steel, riveted in the upper and lap welded in the lower sections, and laid above ground, with expansion joints and masonry anchorages.

The first half of the pipe line will be capable of supplying four 11,000 H.P. turbines and two 850 H.P. exciter turbines.

The power-house building provides at present for five main and two exciter sets, with five transformer banks and switchgear. The equipment now being installed includes, however, only four main units The generator room is spanned by a 67-ton electric travelling crane.

Each waterwheel set comprises an 11,000 H.P. Escher-Wyss horizontal impulse turbine running at 300 R.P.M., coupled to a Siemens 8,000-KW. 5,000-volt, 50-cycle, three-phase generator capable of 20 per cent. overload for ten hours. There are two exciter units, each comprising Escher-Wyss 850-H.P. turbines, running at 600 R.P.M. and coupled to 600-KW. 250-volt, shunt-wound, direct-current Siemens generators.

Four banks of step-up transformers will be installed, each consisting of three 3,333-K.V.A. oil-insulated, water-cooled, 5,250/100,000-volt, 50-cycle, single-phase units, connected delta to delta and having 20 per cent overload capacity for ten hours.

The turbine wheels have cast-steel disks with cast-steel buckets. The shafts are of Siemens-Martin steel with two-ring lubricating bearings equipped for water cooling. The cast-steel nozzles are of the deflecting type. The governors, which operate by oil pressure, are fitted with hydraulic automatic servo-motor precision gearing which is guaranteed to limit the turbine speed variation to 2.5 per cent., 5 per cent. and 12 per cent. respectvely when one-quarter, half or full load is suddenly thrown off. The guaranteed full load efficiencies are 82 per cent. for the main units and 72 per cent for the exciters.

The main generators are each of 8,000 K.W. developing 5,000 volts between phases; their regulation at unity power factor is 9 per cent. and at 80 per cent. power factor, 22 per cent. The guaranteed full load efficiency at 80 per cent. power factor is 94.3 per cent. Each transformer bank consists of three G.E.C. (U.S.A.) single-phase oil-immersed water-cooled 5,000/100,000 volt, 50-cycle transformers designed for a full load output of 3,333-K.V.A. at 80 per cent. power factor. These transformers are of the shell type.

All switchgear in the Khopoli power house is electrically operated from a benchboard on the gallery overlooking the generator room at a point which will eventually be the centre of the building. In addition an auxiliary switchboard for station service, exciter control, generator field-switch panels and signal apparatus are located on the generator-room floor.

The six-panel benchboard, built of blue Vermont marble, controls the four main generators with their step-up transformer banks, two exciters and two outgoing 100,000-volt, 36,000 K.V.A. three-phase lines. The generator-field series rheostats, the turbine governors and the air-duct shutters are all operated by 220-volt. motors. The air-duct shutters are interlocked with the generator-field switches so that when the fields are energized the shutters will be open. The low-tension or 5,000-volt buses are of copper-bar section.

In the transformer high-tension circuits to the outgoing lines automatic oil-break switches are employed; each of these switches has a rupturing capacity of 50,000 K.V.A., automatic protection being afforded by means of series inverse-time-limit overload relays.

The 100,000-volt oil-switch room is located on the floor above the transformer compartments; the lightning-arrester equipment is of the indoor type, the horn-gaps and cells being located in the transmission-line exit tower. Each outgoing line is protected with choke coils and 100,000-volt aluminium-cell arresters.

The transmission line terminates at the receiving station on the island of Bombay, with a total length of 43 miles. On the way the line crosses two tidal creeks (one 10,000ft. wide and 42ft. deep at high tide), a railway and several roadways. Ultimately there will be four transmission lines normally working in parallel, and carried on two lines of towers. Two "change-over" stations with disconnecting switches are provided, by which it is possible to divide the line into three sections for cutting out or inter-connecting different sections as conditions demand. The present contract covers, however, only two transmission circuits carried on one set of towers.

Copper conductors are used of 0.095 sq. in. section spaced 10ft. 6in. between wires, and carried on six-unit suspension-type insulators. The towers are built in two sections, a superstructure and a base, rivetted together at the site. In all about 500 towers are used in the line.

The standard towers are 66ft. high and are spaced 500ft. apart. The special crossing towers are spaced 1,175ft. apart. and have a height of 160ft. to comply with the government requirements that no part of the transmission line shall come within 80ft. of the water at high tide.

The receiving sub-station is located about two miles from the docks. It has been designed for an ultimate capacity of 74,880-K.V.A. in eight step-down three-phase transformer banks of 9,360-K.V.A. each.

The present building provides for five such transformer groups, each consisting of three single-phase, oil-immersed, water-cooled, 85,800/6,600 volt transformers, rated at 3,120-K.V.A. The windings are connected delta to delta.

The switch-gear equipment is generally similar in design, arrangement and layout to that in the power house already described, and consists of remote-controlled electrically-operated oil switches and other apparatus actuated from a benchboard.

Each incoming line is protected with choke coils and aluminium-cell lightning-arrester equipment. A ground bus runs the length of the station.

In 1907 after a lengthy inquiry the Indian government granted a licence giving the Tata company the privilege of supplying hydro-electric energy within Bombay to customers whose consumption exceeded 500,000 K.W.-hr. per annum.

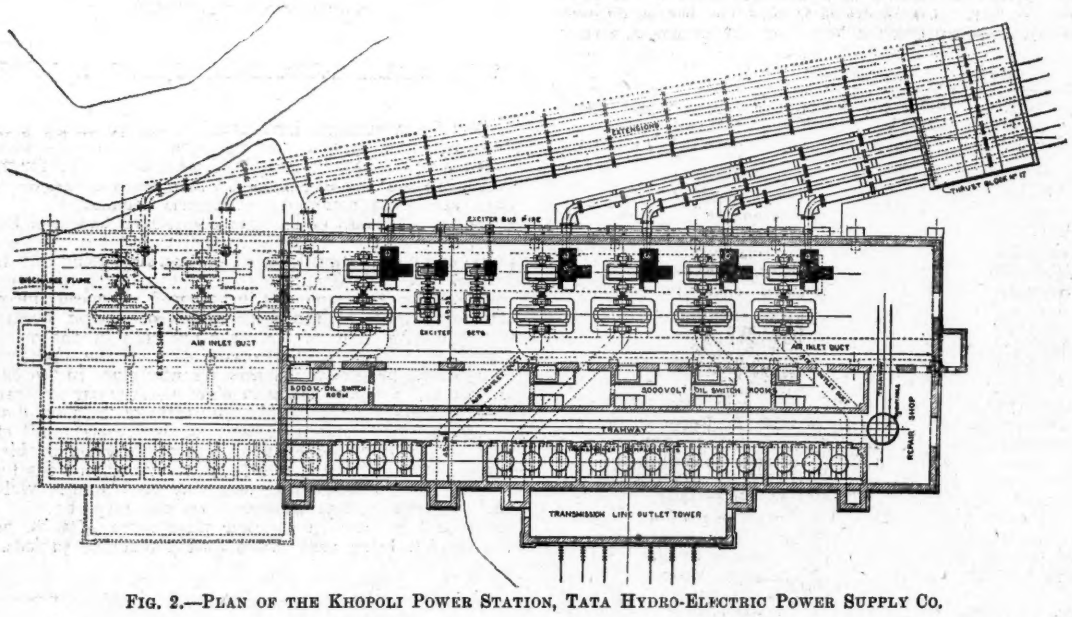


FIG. 2.—PLAN OF THE KHOPOLI POWER STATION, TATA HYDRO-ELECTRIC POWER SUPPLY CO.

A total of thirty-four mills have now contracted for hydro-electric energy from the Tata system.

The terms of the ten-year agreements between the power company and the mill owners cover the supply of energy for purposes of motor drive at 0.55 anna per K.W.-hr. in the case of mills where the electric installation is provided by

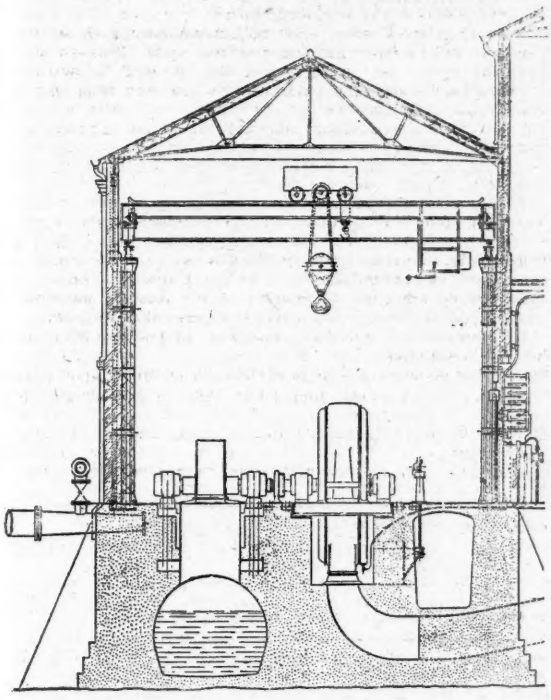


FIG. 3.—SECTIONAL VIEW, KHOPOLI STATION.

the power company, and at 0.50 anna per K.W.-hr. in the case of mills furnishing their own motors and equipment, the company providing and maintaining the mill transformers. Energy for lighting will be supplied at 1.25 anna per K.W.-hr. separately metered, up to 20 per cent. of the energy supplied for power. In the mills the group driving system has been adopted, using 50 cycle 3-ph. slip ring 2,000 volt motors in sizes from 50 to 500 H.P.; in some mills 500 volt motors will

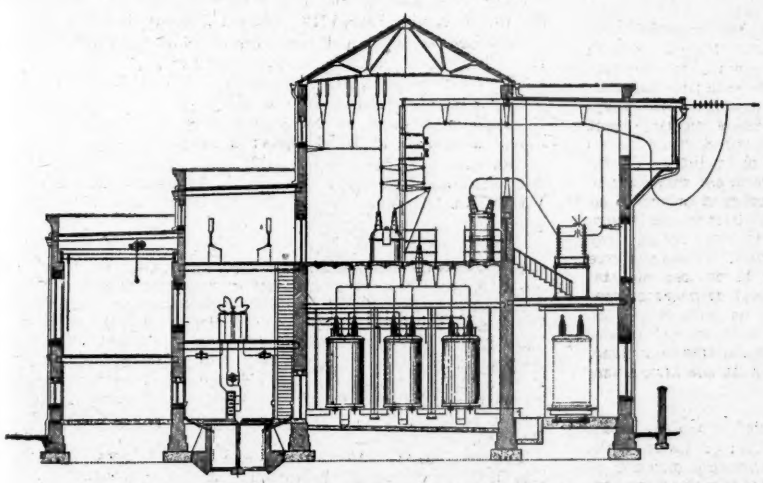


FIG. 4.—SECTIONAL VIEW, BOMBAY RECEIVING STATION.

be used. For distribution purposes the mills are divided into groups, each group having a feeder to each mill, as well as a ring main for all the mills of the group; three-core paper insulated lead sheathed cable, operating at 6,600 volts, and laid solid is used for this service, Messrs Callender being the contractors for the work, while the mill motors, transformers—the latter in 500, 600, 700 and 900 K.V.A. sizes, star-connected on both sides—and switchgear are being supplied by the British Westinghouse Co., and have already been referred to in our pages. The G.E. Co. (U.S.A.) supplied all the transformers and switchgear at both the power house and receiving station in Bombay, while Messrs. Bullers, Ltd., supplied the transmission towers and insulators, and Messrs. Felten and Guilleaume, the copper conductors.

We may add that Messrs. Alfred Dickenson and Co. are consulting engineers for the whole project.

BUSINESS NOTES.

Consular Notes.—Spain.—In a recent issue of the ELECTRICAL REVIEW certain information was given regarding the extensive use of electricity in Barcelona and the operations of the Canadian company which has undertaken to exploit the electrical resources of the district. The British Consul at Barcelona, in a recent report, makes some interesting comments on the subject. It is estimated that the industries of Barcelona are now using 160,000 H.P. (the bulk of consumers not using individually more than 500 H.P.), generated by steam which, owing to the high price of coal, is stated to cost from £15 to £20 per H.P., whereas the company in question has advertised that its electric power will be saleable at a minimum of £6 per H.P., as against an average of £17 per H.P. formerly. If this is so, there can be no doubt that this cheaper power will lead to an enormous extension of the trade of Barcelona and district, as it will enable the manufacturers, on the basis of their present annual cost of working, to increase their production greatly. The company owns all the capital stock of the local power company, and practically all the capital of a local railway company, also the major portion of the shares of a local electric light company, and all, or a controlling interest, in the electric light and power companies of some six towns within a radius of 60 miles of Barcelona.

The company had a possible dangerous competitor in a French company already installed there with the same object called L'Energie Electrique, which had constructed a large steam power station and hydraulic plant on the River Flamisell in the Pyrenees, but it is understood that the new company has done away with any opposition by taking a half interest and an option on the balance, with a working agreement to avoid duplication in distribution. The company has also purchased the suburban railway running from Barcelona to some towns in the neighbourhood, and proposes to make extensions. Also the company has leased the existing tramway system here for 60 years, and holds 40 per cent. of the shares. It will thus be seen that it holds in its hands all the undertakings working by electric power to which it will in future supply the said power. The local company owns concessions for the development of various water powers on the River Noguera Pallaresa and River Segre, and is now building plants which will develop a total of some 136,000 H.P. The first of these, which will develop some 4,000 H.P. is located near the town of Pobla, province of Lerida, and is nearly completed. The second is situated near the town of Seros and will have a capacity of some 56,000 H.P.; this will, it is expected, be finished by the end of the year. The third, which will be located on the River Noguera Pallaresa above its confluence with the River Segre, will develop some 70,000 H.P. and is expected to be completed in 1914. The flow of the river for this will be regulated by means of a reservoir situated near the town of Tremp, and the construction of this reservoir will create sufficient storage to ensure a practically steady flow of the river throughout the year. The energy produced will be transmitted to Barcelona and the surrounding region at 110,000 volts, by two transmission lines on steel poles, a distance of 200 km. (about 135 miles). These lines of transmission will end in transformation stations established outside the town, whence the current reduced to a lower pressure will be distributed by a vast system of canalisation. The company has already contracts covering the supply of some 100,000 H.P. for lighting and power purposes, and has also in addition a contract for the supply of a very large amount of power for the manufacture of nitrate in Lerida. It is, of course, still early days to speak as to the effect on Catalonia of this gigantic scheme, and the expenditure in and near Barcelona of many millions of pounds sterling; but if the scheme turns out all that its promoters hope and promise, it will revolutionise this part of Spain, vastly increasing its present wealth and great business enterprises and promoting a general prosperity among all classes. Meantime this influx of millions of money into a comparatively small district and the giving of employment to thousands of workmen and to a large staff of engineers, accountants, managers, clerks, &c., all of whom are liberally paid, has produced a wave of prosperity, and money is plentiful. In conclusion, it is an important fact that this great undertaking is also benefiting British commerce, for independent of orders placed here with the representatives of British houses for various articles required in connection with the hydraulic and railway works, orders have also been given, through the company's buying agent in London, direct to British firms, representing during 1912 some £300,000. Including the orders given to British agents here as before mentioned, British firms have benefited to the extent of about £500,000 already, and it is likely that every year will continue to see good orders placed in the United Kingdom.

In this connection, the Consul states elsewhere in his report that a British firm established in Barcelona has informed him that there has been a fair increase in the machinery trade in recent years, and that the feature of most interest is the importance of British-made

electrical machinery, which is now in a fair way to compete with German makes. In spite of this market having up to the present been dominated entirely by German electrical firms, there has been a considerable importation from the United Kingdom of boilers and accessories, general machinery, tubes and electrical machinery; but at the same time it appears that the terms quoted by British firms are not as favourable as those of German manufacturers.

India.—Reporting recently on the market for electric wiring devices in India, the American Consul states that the new houses in Bombay show considerable improvement over the older structures from an architectural standpoint, and are planned more in accordance with sanitary requirements. There are, however, few, if any, fireproof buildings in the city. In the native quarter, or bazaar district, wooden buildings predominate, and in many of the new structures, on account of the increased cost of building material and the high wages of labour, safety and durability have been less considered than a high return upon investment. In the city proper, business structures and residential apartment houses and all public buildings are built of stone. Steel construction has not been introduced, except for warehouses. Lights and fans operate on a 230-volt direct-current, three-wire system. The suburbs of Bombay are supplied with an alternating-current installation of 230 volts. Under the system of electric wiring commonly employed, and found to be most suitable for general installation, the wires are carried over the surface of the walls and ceilings on hard wood cleats; the latter are separated by 2-ft. spaces, and the whole is enclosed in a teak or oak casing. Wire contact with the wall surface must be carefully avoided or the installation will require renewal in about two years. In this heavily saturated atmosphere the trap and porous lime building stone so largely used in Bombay absorbs a great deal of moisture, and the leaching process, which quickly follows, seriously damages electric installations unless the walls are thoroughly protected. Conduit wiring systems that involve burying the wires in the wall or ceiling have been tried, but found unsatisfactory, for general purposes. For the wiring of Government and municipal buildings the contract specifies insulated, steel-armoured conduit, but the work is carried over the wall surface. Non-insulated conduit work has been put into the majority of mills. Dealers state that an improved system that would lower the present cost of wiring would find a ready sale if it met all tests. In this regard mention may be made of the new wiring system recently introduced into Bombay by Henley's. Many public and business buildings have been wired with it, and it is said to work out cheaper than the conduit method both on account of the low cost of material and reduced labour expenses for erection. Conditions in the electric specialty or electric light supply trade are far from satisfactory. There are in Bombay at least 100 dealers, many of whom claim to be electrical engineers, and the overcrowding in this line is partly responsible for an extended system of price-cutting. The most reliable and old-established European firms of electrical engineers are keenly feeling the competition of native firms, and while the volume of trade is large, it is being handled at present on a dangerously low margin of profit. The dealers are steadily reducing the quality of stock carried in order to meet the demand for low-priced material. The United Kingdom furnishes over three-fifths of the electrical supplies imported into Western India. Germany has a small, but slowly growing, share of this trade, while Belgian, French and Italian manufacturers have all lost ground in the last five years. There is practically no direct trade in this line with the United States, and the principal firms among the local dealers manifest very little interest in American-made electric light material. They are inclined to argue that American goods are too high priced for the market, and in discussing the point the Consul was told that the manufacture of British electrical merchandise has been so developed, and the cost of production so reduced, that German manufacturers were finding it difficult to meet their competition. But probably the chief obstacle in the way of American trade development is distance from the market. Goods ordered from London are received at Bombay in 10 or 11 weeks; at least twice that time would elapse before the arrival of goods ordered from America. The sockets in use throughout India are of the bayonet cap type. Rotary and push-button switches are carried in stock, but dealers state that the demand runs almost exclusively to switches of the tumbler type. Pendant switches have a very limited sale.

Book Notices.—*The Electrical Engineer's Diary*, 1914. Edited by J. H. Johnson, M.I.E.E. London: S. Davis & Co. Price 3s. 6d.—As our readers are aware, this volume is much more than a diary; it contains a mass of useful information for consulting engineers, contractors, central-station managers and others concerned in the supply and use of electrical apparatus, under the heads of General Information, the Generation of Electricity, Official Rules and Regulations, the Application of Electricity for Lighting, Heating and Cooking, and the Application of Electricity for Power Purposes. There is also a list of London streets in which electricity mains are laid, stating the authorities concerned in each case, and a list of electricity supply authorities in the United Kingdom. Altogether it is a most useful desk companion.

Fowler's Mechanical Engineer's Pocket Book for 1914 (Scientific Publishing Co., price 1s. 6d. net) is now in its 16th year, and contains an inexhaustible store of information on all branches of mechanical engineering. From a cursory inspection of the contents, which are of too miscellaneous a character for detailed review, we are satisfied that they are kept well up to date, and we have no hesitation in recommending the work.

Fowler's Mechanics' and Machinists' Pocket Book and Diary for 1914 (price 6d. net) is another well-known book of reference, of the greatest utility in the drawing office, machine shop, and tool room, and emanates from the same publishing office, both books being edited by Mr. W. H. Fowler. This book is equally deserving of commendation.

The International Whitaker, 1914. London. 2s. 0d.—We commented favourably on this publication a year ago, when it made its first appearance. In this, the second edition, the information relating to different countries has been revised from official sources, and in these days, when most seriously-minded men are world students, and so many business men are world travellers, we feel that the book meets a need, and that it will be welcomed. Information concerning populations, products and industries, and other main characteristics, of the different countries is brought together, beginning alphabetically with Abyssinia, and going on to Venezuela. At the end many pages are occupied with names, &c., of diplomatic and Consular representatives of the United Kingdom and United States in foreign countries.

The Chamber of Commerce Journal has issued its usual "Annual Trade Review." It consists of 50 foolscap pages, contains numerous articles by experts on the leading trades, including engineering, electrical, building, &c., and on all the more important commercial and industrial centres of the United Kingdom. It is published as a special supplement to the January issue of the *Journal*, and forms very interesting and instructive reading.

We offer our hearty congratulations to the *Railway News* on its bumper Jubilee issue (5s.). It is a wonderful production, telling by pen and picture many parts of the story of 50 years of railway progress. The *News* was founded in 1864 by Dr. Samuel Smiles and Mr. E. McDermott. One of the most attractive features among the contents is a series of most interesting pictures reminiscent of very early railway days. There are numerous articles on railway subjects which have been specially written for the issue by authorities.

"Willing's Press Guide"—issued from 125, Strand, at 1s.—is a most convenient alphabetical and classified guide to the Press. That it meets a real want is evidenced by the fact that it has now reached its forty-first annual appearance.

The January number of the *Hospital Gazette* is a special one, containing a fully-illustrated description of the new King's College Hospital, including the electric installation, which contains an auxiliary electric plant, electric fans, lifts, boiling apparatus, sterilisers, X-ray and electro-medical equipments, telephones, &c. Messrs. Kirkland & Capper acted as consulting engineers for the work.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXIX, No. 10. December, 1913. New York: The Society.

"Annales des Postes, Télégraphes et Téléphones." December, 1913. Paris: A. Dumas. Price 10 fr.

"Coal-Mine Accidents in the United States and Foreign Countries," by F. W. Horton; "Monthly Statement of Coal-Mine Fatalities in the U.S.," September, 1913, by A. H. Fay. Washington: Government Printing Office.

"*Journal* of the American Institute of Architects." Vol. I, No. 12. December, 1913. Washington: The Institute. Price 20 cents.

"Atti della Associazione Electrotecnica Italiana." Vol. XVII, No. 23. December 15th, 1913. Milan: Stucchi, Ceretti & Co.

"*Proceedings* of the Rugby Engineering Society." Vol. X, 1912-1913. Rugby: The Society. Price 10s. 6d.

"Fees for Electric, Magnetic and Photometric Testing." 1913. Washington: Government Printing Office.

"*Bulletin* Mensuel of the Société Belge d'Electriciens." Vol. XXX. December, 1913. Brussels: E. Bruylant. Price 1 fr. 75.

"Revista Tecnologico-Industrial." (Publicacion Mensuel de la Asociacion de Ingenieros Industriales Agrupacion de Barcelona) Vol. 36, No. 11. November, 1913. Barcelona: The Association.

Fires.—A serious fire occurred on the 10th inst. at the engine works of MESSRS. CLARKE, CHAPMAN & CO., LTD., Gateshead-on-Tyne, one of the power sub-stations being completely destroyed. The plant, which included dynamos, transformers, motors, &c., was burnt and twisted beyond all recognition, and the amount of the damage, it was reckoned, would run into several thousands. As practically all the plant was electrically driven, and the place lighted by the same means, it was feared that a serious stoppage would ensue, but fortunately the management were enabled to install such plant as was essential so quickly that this was obviated.

The premises of MESSRS. TYLER & SONS, engineers, York Road, King's Cross, were partly destroyed by fire on 11th inst.

Bankruptcy Proceedings. — CHARLES HELLYER PEARSON (trading as Pearson & Co. and the B.O.A. Engineering Co., of Manchester and Hyde, electrical, mechanical and sanitary engineer, decorator and plumber).—Last day for receiving proofs for dividend, January 26th. Trustee, Mr. A. Yearsley, 27, Brazennose Street, Manchester.

C. S. NORTHCOTE, electrical engineer, 67, Stanthorpe Road, Streatham, S.W.—Trustee (Mr. E. W. J. Savill, 132, York Road, S.E.) released November 20th, 1913.

Electric Smelting in Sweden.—The output of electric pig-iron in Sweden has grown from 122 tons in 1908 and 870 tons in 1910 to no less than 17,566 tons in 1912. At the end of 1912 there were nine furnaces at work, rated at 14,700 KW., and in 1913 the number was increased to 20, rated at 41,500 KW. In 1911, 2,034 tons of steel were produced with the electric furnace in Sweden—almost as much as with the crucible.

Trade Announcements.—MR. J. PENDREICH has resigned his position as manager with Messrs. Millar & Stewart, Edinburgh, and has started business as the Pendreich Electrical Firm, wholesale agents and factors, at 250-251, Daley Road, Edinburgh. Catalogues and lists are desired.

MR. LIONEL ROBINSON has been appointed sole agent in this country for the electrical trade by Messrs. Showell & Son of Stirchley, Birmingham, and will handle business in turned, screwed and stamped repetition work. Messrs. Showell, who for some years have been located in Birmingham, recently erected an up-to-date factory on one floor, outside the city, at Stirchley. It is equipped with modern machinery for automatic and turned parts, and repetition stamped work made by up-to-date combination tools is a speciality.

MR. CHARLES LANG has removed from Finsbury Pavement to No. 4, Mincing Lane, E.C. "Telephone, London Wall, 4459." Mr. Lang is London agent for the Cable Accessories Co., Ltd., of Tividale, Tipton, Staffs.

With reference to our notice of last week regarding the WALSALL HARDWARE MANUFACTURING Co.'s new depôt in London, we understand that Mr. C. G. Maisey, late of Messrs. J. & H. Grevener, is acting as London manager of the company, and he will in future be devoting his entire attention to that business. The Walsall Co. last year took two acres at Walsall for extensions, and a new foundry has now been completed, with the result that at the new depôt in London very large stocks of steel conduit and fittings will be carried.

MESSRS. WALTER NEWBOLD & Co. announce that their telephone numbers are now "City 3718 and 5098."

MESSRS. ROSE BROS., of 38 and 39, Beech Street, Barbican, London, E.C., have been appointed sole British agents for the Cie. F.A.C. Da and Dutilh of Paris. Circulars have been received of specialities for wireless telegraphy and of the "Wescoscope" home cinematograph.

THE RADIUM ELECTRIC Co., 82, Hatton Garden, London, E.C.—Illustrated price list of the "Pioneer" combined electrical beauty massage and manicure machine, also the Rapid and Monsoon hot-air douches.

MESSRS. G. W. GOODCHILD & MACNAB, of Eagle Street, W.C., announce that their new telephone number is "Holborn 6405."

MESSRS. WOOLLETT, AIREY & Co., LTD., shipping agents, ask their electrical friends to take note of their change of address from Lime Street, E.C., to 47-51, King William Street, London, E.C. Telephone numbers, "City 6,934 and 5."

Catalogues and Lists.—THE ELECTRICAL Co., LTD., 122-124, Charing Cross Road, London, W.C.—The first number of the "E.C. Journal," which it is intended to issue monthly, has been received. Particulars appear of the different A.E.G. factories, their floor space, and tool and motor equipments, motors in stock, half-watt "Nitra" lamps, prepayment meters, and other matters. There are also comparative curves of the prices of raw materials used in electrical manufacturing for last year and the year before. A separate motor stock list, a circular describing the "Auto-ray" sign, and a 4-in. metal rule giving English and metric measures have also been received.

BRITISH ALUMINIUM Co., LTD., 109, Queen Victoria Street, London, E.C.—Illustrated leaflets relating to aluminium insulation for magnet coils, aluminium netting and gauze, aluminium in the automobile chassis, and aluminium mandrils for rubber manufacturers.

THE ELECTRICAL SUPPLIES Co., 41, Cheapside, London, E.C.—Illustrated folder giving prices of a number of designs of electric fires and radiators, including the Ensign and the Calor fires, hot-bar radiators, also luminous and convector types.

MESSRS. W. CANNING & Co., 133 to 137, Great Hampton Street, Birmingham.—Section 1 D of their catalogue (32 pages) contains very fully-illustrated information, with tabulated details and prices of low-voltage dynamos, motor-generators, shunt regulators and electrical accessories, &c., for electroplating, electrotyping, electro-chemical processes, &c. Directions are given for fixing and working the electroplating dynamos and for charging motor-car accumulators from plating dynamos.

MESSRS. SIMPLEX CONDUITS, LTD., 116, Charing Cross Road, London, W.C.—Supplementary sheet T 5 is a four-page list giving illustrated particulars and reduced prices of their Universal conduit boxes.

WESTINGHOUSE COOPER HEWITT Co., LTD., 80, York Road, King's Cross, London, N.—Illustrated list No. 66 describes a continuous-type blue-printing outfit (Everett McAdam system) and tabulates sizes, weights and prices of same.

Liquidations.—THE ORO LIGHT AND GENERAL SUPPLY Co., LTD.—A final meeting for the winding up of this company is called for February 11th, at 36, Cock Lane, London, E.C., by the liquidator, Mr. C. Harris.

PRESTON ELECTRIC Co., LTD.—A meeting will be held at 12, Bennett's Hill, Birmingham, on February 16th, to hear an account of the winding-up from the liquidator, Mr. T. L. Rawlins.

GRINDELL-MATTHEWS WIRELESS TELEPHONE SYNDICATE, LTD.—In the Companies' Winding-up Court on Tuesday, Mr. Justice Astbury, on the petition of J. G. Pullen & Sons, made a compulsory order for the winding up of this syndicate. The petition was unopposed, and the company did not appear. Mr. M. M. Macnaghten appeared for the petitioners.

Portsmouth Dockyard Fire.—At the Coroner's inquest last week evidence was given showing that the fire could not possibly have been due to electricity, as the current was off the circuit at the time when the fire broke out.

Calendars and Diaries.—THE BRITISH THOMSON-HOUSTON Co., LTD., of Rugby, have again issued one of their large and useful wall calendars for 1914. As before there are three months' dates shown very clearly on each of 12 sheets, the preceding and the following months being printed less conspicuously than the current month. Half-tone views of electrical equipments for collieries and industrial works, also the firm's arc and incandescent lighting and other specialities, are appropriately worked into the design. Addresses and telephone numbers of the different branch offices and departments of the company in the United Kingdom appear.

From the GENERAL ELECTRIC Co., LTD., we have received a set of refill engagement slips for 1914, for use on their desk calendar received a year ago.

From MESSRS. MAWDSLEYS, LTD., of Zone Works, Dursley, Glos., we have received a pictorial wall calendar with monthly date slips. "When Autumn Breezes Blow," (W. H. Margetson), comes as a very cheering subject in these days of wintry blasts.

MESSRS. FLOWERDEW & Co., technical translators, of 14, Bell Yard, Temple Bar, W.C., have issued a small wall calendar with monthly slips.

From MESSRS. SIMPLEX CONDUITS, LTD., we have received a pocket diary—one of the most practical that we have seen—and a desk fitting built up of Simplex conduit, to hold pencils, rubber and compasses, all of which are included, making a very convenient device; as the pencils are supported in a vertical position, they can be seen at once, and need not be groped for under loose papers, &c.

Exhibition at Lyons.—An International Urban Exhibition will be held at Lyons from May 1st to November 1st, to which, probably, a Colonial exhibition will be joined. The exhibition will be divided into 52 sections, those of interest to electricians being the following:—Section III, Transport; Section IV, Mines, metallurgy, machines; Section XVIII, Light and lighting; Section XIX, Ventilation, heating, refrigeration; Section LI, Electricity; Section LII, Posts, telegraphs, telephones. Section LI is subdivided as follows:—Class 281, "White coal," rivers, reservoirs, weirs, canals, tunnels, high-pressure channels, &c., *i.e.*, all works relating to the utilisation of waterfalls. Class 282, Hydraulic motors and heat engines, dynamos, alternators, exciters, switchboards, accumulators, &c., *i.e.*, all equipment plant for power houses. Class 282 *bis*, Transmission of electricity, cables, conductors, posts supports, insulators, lightning conductors, transformers, &c., *i.e.*, all apparatus relating to the transmission of electricity from the power house to the consumer. Class 283, Use of electricity in other ways than for lighting—electrometallurgy, electro-chemistry, furnaces, electrodes and sundry tools, electric motors, heaters, apparatus for the use of electricity in agriculture and industries, &c., *i.e.*, all electrical apparatus save those for lighting.

Spain.—The *Gaceta Oficial* (Madrid) of December 30th contains the list, published annually, of the various classes of material which may be required by Spanish Government departments, and in the supply of which foreign competition will be permitted, during 1914. The following are among the items:—Manufactured steel and wire; steel rails; tubes and cables; brass, nickel, aluminium, platinum, bronze and copper goods; steam turbines; locomotives; gas engines exceeding 300 H.P.; steam boilers; tools; metal testing machines; electrical apparatus for medical laboratories; telegraph and telephone appliances; electric searchlights; submarine cables; electric lighting accessories and arc lamps; electric generating machines; scientific instruments. The *Gaceta* containing the detailed list may be seen at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.—*Board of Trade Journal.*

Ship Lighting.—THE EDISON AND SWAN UNITED ELECTRIC LIGHT Co., LTD., have again this year secured a contract for the supply of "Royal Ediswan Lamps" to the Cunard Steamship Co., Ltd., Elder, Dempster & Co., Ltd., and Cammell, Laird & Co. Ltd.

For Sale.—The Sheffield Tramways Department will shortly have for disposal a further quantity of G.E. 52 traction motors (5 or 6-turn armatures). Fulham Corporation has for disposal a 300-KW. two-phase Musgrave-G.E.C. steam alternator. Messrs. Davis & Timmins, Ltd., have for sale two 100-KW. sets, gas engines and direct-coupled dynamos, and two suction producer gas plants, motors, lamps, &c. Particulars are given in our advertisement pages to-day.

LIGHTING and POWER NOTES.

Accrington.—At a meeting of the T.C. last week, it was stated that the total cost of fuel per unit generated at the electricity works was 0·2d., and if the value of by-products was deducted, the figure was reduced to 0·13d., which was the lowest in the country.

Altrincham.—STREET LIGHTING.—The Altrincham Electric Supply, Ltd., has informed the Council that it can supply energy for street lighting at 2d. per unit, and the Council is to obtain a scheme and estimates for lighting George Street.

Aldershot.—VIBRATION COMPLAINT.—A further complaint was received by the D.C. last week of the vibration caused by the Diesel engine at the electricity station. The chairman of the E.L. Committee said the Diesel Co. agreed to indemnify the Council against all actions, but until some action was taken the company would refuse to act. It was decided to send a copy of the letter to the company.

Argentina.—The Tucuman Municipality will shortly be calling for tenders for street lighting, the existing contract with the Eléctrica del Norte Co. having almost expired.—*Review of the River Plate.*

Australia.—The Heidelberg (V.) Shire Council has decided to adopt an electric light scheme at a cost of £10,000.—*Australian Mining Standard.*

Blackpool. — A proposal is on foot to introduce the "rateable value" system of charging with a primary charge of 12½ per cent. on the rateable value of the house, plus ½d. per unit consumed.

The engineer, Mr. Furness, anticipates that the concession will cost the department £600 a year in connection with a section of the consumers, but advantages will be secured.

Braintree.—PROPOSED E.L. SCHEME.—The Committee which has the E.L. scheme in hand has visited the Grays electricity works, but has reported that it requires further information before presenting a definite report.

The U.D.C. has decided to approach the Bocking Council with a view to including that parish in the scheme.

Bradford.—SCHOOL LIGHTING.—The Hanson School Committee is considering the installing of electric light at the school.

Bulkington. — PROV. ORDER.—The U.D.C. has appointed a deputation to confer with the Foleshill R.D.C. relative to the application of the Midland Electric Light and Power Co. for a prov. order for electric light in its area, and also in the parish of Bedworth. At the request of the Bedworth P.C., the Foleshill R.D.C. has decided to oppose the application.

Canada.—A by-law was passed at Winnipeg on December 12th authorising the expenditure of $1,000,000 for extensions on the municipal hydro-electric system.—*Canadian Electrical News.*

The Port Arthur, Ont., electricity department shows a net profit of $62,000 for 1913. The city is using 2,100 H.P. from the Hydro-Electric Commission, and 700 H.P. from the Current River station. The storage capacity of the various dams is 1,843,100,000 cb. ft. *Canadian Engineer.*

Cambuslang (Lanark).—SCHOOL LIGHTING.—The School Board has decided to light the school in course of erection at Gateshead, by electricity.

Carlisle.—LOAN SANCTIONS.—The L.G.B. has sanctioned the borrowing by the Corporation of £7,970 for extensions to the plant and buildings at the electricity works, and £4,300 for installing high-tension plant.

Chile.—Decrees have been issued approving the plans submitted by Sres. J. Horde, A. Munoz and others for an E.L. installation in Aranco, and those submitted by Lochnert, Eberhard & Co. for an E.L. plant in Thomé.—*Board of Trade Journal.*

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South Africa.—The Cradock Municipality will shortly put forward a proposal to raise a loan not exceeding £10,000 for the purpose of installing E.L. in the town.—*Board of Trade Journal.*

The Paarl (Cape Province) T.C. has approved the plans for the proposed E.L. installation, and tenders will now be invited for the work, which is estimated to cost £35,000.

Southport.—A sub-committee has been appointed to consider a report of the electrical engineer containing suggestions for making the electricity estate more remunerative.

Stone (Staffs.).—The U.D.C. has decided to oppose the Stone Gas and Electricity Bill.

Tenby.—PROV. ORDER.—The T.C. has decided to oppose the prov. order for E.L. for which Mr. J. H. Edwards, of Bristol, is applying.

Wakefield.—L.G.B. INQUIRY.—At an inquiry by Mr. T. C. Ekin into the proposed borrowing by the Corporation of £13,034 for electricity extensions, it was explained that additions were to be made to the works to meet the rapidly increasing demand, and to secure increased economy in operation. Tenders for the work have been provisionally accepted. The amount is made up as follows:—Boiler house plant, £2,613; engine room plant, £8,251; switchboard extensions, £323; and H.T. distributing sub-stations, £1,721. The electrical engineer stated that it was not intended to discard any of the plant at present in use, but to add another set, consisting of a turbine-driven alternator, condensing plant and filter. There was no opposition.

West Hartlepool.—PROPOSED LOAN.—The T.C. has decided to apply to the L.G.B. for sanction to a loan of £3,000 for electricity mains and services during the next three years.

Wrexham.—PROV. ORDER.—The T.C. has resolved to apply for a prov. order to include the garden village at Acton within its area of supply for electricity purposes.

West Yorkshire.—E.L. PROPOSALS.—In connection with the decision of the Yorkshire Electric Power Co. to apply to Parliament for powers to supply current for lighting purposes in various districts, the following decisions have been come to by municipal authorities who have been appealed to for their support to the application:—The Batley Corporation has appointed a sub-Committee to take what action it thinks best in the interests of the Council; the West Riding District Councils' Association has resolved to hold a conference to discuss the Bill; the Queensbury District Council has decided to protest against the monopoly which the Bill would set up and to further consider the matter later; the Thorne District Council has referred the matter to Committee without having the letter from the company read; the Clayton District Council has instructed its clerk to write to the company to ascertain the time in which it would guarantee a supply of electricity, and on what terms, there being a suggestion that further application should be made for a supply from the Bradford Corporation; the Southowram District Council has passed a resolution referring the matter to the Special Street Lighting sub-Committee for consideration, because of the serious inroad which would be made into the rights of District Councils if the company was granted a monopoly in the matter of electricity supply in those areas where the Councils had not provisional orders for the supply of current themselves; the Shepley District Council has instructed the clerk to ascertain whether the Council committed itself to any liability in giving its support; the Newmill Council has not decided upon any action: the Thurstonland District Council has passed a resolution favouring the application by the company for lighting powers; the Skelmanthorpe Council has resolved to support the company; the Normanton Urban District Council has decided to allow the letter from the company to lie on the table; the Royston District Council has instructed the clerk to obtain further information on the matter; the Horbury District Council has appointed a sub-Committee of six to deal with the matter; the Monk Bretton Council has informed the company that the Council had no objection to the application; the Darfield Urban District Council has decided to let the letter lie on the table, though an opinion was expressed that the powers sought by the company would provide it with a monopoly of supply in the district; and the clerk to the Ardsley District Council has been instructed to obtain further information for submission at a future meeting.

Middlesbrough.—Arrangements have recently been concluded for the establishment by Tarmac, Ltd., of Wolverhampton, of new works at Middlesbrough, on land belonging to the North-Eastern Steel Co., Ltd. These new works will commence with an output of 2,000 to 2,500 tons per week of tarred slag, manufactured from slag produced at the North-Eastern Steel Co.'s blast furnaces; the new machinery will be electrically operated, current being taken from the supply network of the Cleveland and Durham Electric Power, Ltd.

Portrush.—The U.D.C. has decided to advertise for an engineer for the proposed E.L. scheme.

Penmaenmawr.—E.L. SCHEME.—The North Wales P. and T. Co. has intimated to the U.D.C. that it would be prepared to supply electricity on contract for seven years, the Council to have the option of renewing the contract for a further five years.

Aldershot.—VIBRATION COMPLAINT.—A further complaint was received by the D.C. last week of the vibration caused by the Diesel engine at the electricity station. The chairman of the E.L. Committee said the Diesel Co. agreed to indemnify the Council against all actions, but until some action was taken the company would refuse to act. It was decided to send a copy of the letter to the company.

Argentina.—The Tucuman Municipality will shortly be calling for tenders for street lighting, the existing contract with the Eléctrica del Norte Co. having almost expired.—*Review of the River Plate.*

Australia.—The Heidelberg (V.) Shire Council has decided to adopt an electric light scheme at a cost of £10,000.—*Australian Mining Standard.*

Blackpool. — A proposal is on foot to introduce the "rateable value" system of charging with a primary charge of 12½ per cent. on the rateable value of the house, plus ½d. per unit consumed.

The engineer, Mr. Furness, anticipates that the concession will cost the department £600 a year in connection with a section of the consumers, but advantages will be secured.

Braintree.—PROPOSED E.L. SCHEME.—The Committee which has the E.L. scheme in hand has visited the Grays electricity works, but has reported that it requires further information before presenting a definite report.

The U.D.C. has decided to approach the Bocking Council with a view to including that parish in the scheme.

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Bulkington. — PROV. ORDER.—The U.D.C. has appointed a deputation to confer with the Foleshill R.D.C. relative to the application of the Midland Electric Light and Power Co. for a prov. order for electric light in its area, and also in the parish of Bedworth. At the request of the Bedworth P.C., the Foleshill R.D.C. has decided to oppose the application.

Canada.—A by-law was passed at Winnipeg on December 12th authorising the expenditure of $1,000,000 for extensions on the municipal hydro-electric system.—*Canadian Electrical News.*

The Port Arthur, Ont., electricity department shows a net profit of $62,000 for 1913. The city is using 2,100 H.P. from the Hydro-Electric Commission, and 700 H.P. from the Current River station. The storage capacity of the various dams is 1,843,100,000 cb. ft. *Canadian Engineer.*

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Southport.—A sub-committee has been appointed to consider a report of the electrical engineer containing suggestions for making the electricity estate more remunerative.

Stone (Staffs.).—The U.D.C. has decided to oppose the Stone Gas and Electricity Bill.

Tenby.—PROV. ORDER.—The T.C. has decided to oppose the prov. order for E.L. for which Mr. J. H. Edwards, of Bristol, is applying.

Wakefield.—L.G.B. INQUIRY.—At an inquiry by Mr. T. C. Ekin into the proposed borrowing by the Corporation of £13,034 for electricity extensions, it was explained that additions were to be made to the works to meet the rapidly increasing demand, and to secure increased economy in operation. Tenders for the work have been provisionally accepted. The amount is made up as follows :—Boiler house plant, £2,613 ; engine room plant, £8,251 ; switchboard extensions, £323 ; and H.T. distributing sub-stations, £1,721. The electrical engineer stated that it was not intended to discard any of the plant at present in use, but to add another set, consisting of a turbine-driven alternator, condensing plant and filter. There was no opposition.

West Hartlepool.—PROPOSED LOAN.—The T.C. has decided to apply to the L.G.B. for sanction to a loan of £3,000 for electricity mains and services during the next three years.

Wrexham.—PROV. ORDER.—The T.C. has resolved to apply for a prov. order to include the garden village at Acton within its area of supply for electricity purposes.

West Yorkshire.—E.L. PROPOSALS.—In connection with the decision of the Yorkshire Electric Power Co. to apply to Parliament for powers to supply current for lighting purposes in various districts, the following decisions have been come to by municipal authorities who have been appealed to for their support to the application :—The Batley Corporation has appointed a sub-Committee to take what action it thinks best in the interests of the Council ; the West Riding District Councils' Association has resolved to hold a conference to discuss the Bill ; the Queensbury District Council has decided to protest against the monopoly which the Bill would set up and to further consider the matter later ; the Thorne District Council has referred the matter to Committee without having the letter from the company read ; the Clayton District Council has instructed its clerk to write to the company to ascertain the time in which it would guarantee a supply of electricity, and on what terms, there being a suggestion that further application should be made for a supply from the Bradford Corporation ; the Southowram District Council has passed a resolution referring the matter to the Special Street Lighting sub-Committee for consideration, because of the serious inroad which would be made into the rights of District Councils if the company was granted a monopoly in the matter of electricity supply in those areas where the Councils had not provisional orders for the supply of current themselves ; the Shepley District Council has instructed the clerk to ascertain whether the Council committed itself to any liability in giving its support ; the Newmill Council has not decided upon any action : the Thurstonland District Council has passed a resolution favouring the application by the company for lighting powers ; the Skelmanthorpe Council has resolved to support the company ; the Normanton Urban District Council has decided to allow the letter from the company to lie on the table ; the Royston District Council has instructed the clerk to obtain further information on the matter ; the Horbury District Council has appointed a sub-Committee of six to deal with the matter ; the Monk Bretton Council has informed the company that the Council had no objection to the application : the Darfield Urban District Council has decided to let the letter lie on the table, though an opinion was expressed that the powers sought by the company would provide it with a monopoly of supply in the district ; and the clerk to the Ardsley District Council has been instructed to obtain further information for submission at a future meeting.

Middlesbrough.—Arrangements have recently been concluded for the establishment by Tarmac, Ltd., of Wolverhampton, of new works at Middlesbrough, on land belonging to the North-Eastern Steel Co., Ltd. These new works will commence with an output of 2,000 to 2,500 tons per week of tarred slag, manufactured from slag produced at the North-Eastern Steel Co.'s blast furnaces ; the new machinery will be electrically operated, current being taken from the supply network of the Cleveland and Durham Electric Power, Ltd.

Portrush.—The U.D.C. has decided to advertise for an engineer for the proposed E.L. scheme.

Penmaenmawr.—E.L. SCHEME.—The North Wales P. and T. Co. has intimated to the U.D.C. that it would be prepared to supply electricity on contract for seven years, the Council to have the option of renewing the contract for a further five years.

The charge would be a flat rate of 1½d. per unit up to 24,000 units, and 1d. per unit for all above that amount, with a minimum of £120 per annum for the first two years, and £150 for the remaining five years. The Council decided to consider the matter at its next meeting.

Walsall.—The Electricity Committee has recommended that subject to the approval of the L.G.B. and B. of T., land be purchased in Green Lane, Birchills, as a site for the proposed generating station, and that Mr. E. M. Lacey be appointed consulting engineer.

Sunbury.—PROPOSED E.L. SCHEME.—The U.D.C. has considered the plans of an E.L. scheme for the district, proposed to be carried out by a private company. The Clerk expressed the opinion that the proposed area of supply was very large, embracing as it did two urban districts and six other parishes, and that it was inexpedient that so large an area should be embraced in one order. He added that the compulsory area was exceedingly small, while the prices for energy mentioned by the promoter were rather high. The Council decided to consider the matter further.

TRAMWAY and RAILWAY NOTES.

Blackpool.—The Tramways Committee has sanctioned the introduction of ½d. fares for children on the Corporation cars.

Bradford.—Renewals of tramway track in various parts of the city, estimated to cost nearly £29,000, are to be carried out. The equipment of the railless traction route to Oakenshaw is to be commenced forthwith.

RAILLESS TRACTION EXTENSIONS.—The Tramways Committee has decided to recommend the City Council to purchase 28 railless traction vehicles, which will be mainly used for extending the existing route to Bankfoot.

Burley-in-Wharfedale.—The U.D.C. has passed a resolution opposing the proposal of the Leeds Council to run a system of railless traction to Burley.

Burnley.—The T.C. has rejected a proposal to run motor-'buses in certain parts of the town until the electric tramways could be extended into those localities.

Chile.—Decrees have been issued approving the plans submitted by Sr. Antonio Bellet for the construction of an electric railway to join up Villa Alegre station with Villa Alegre town, in the province of Lináres; by the Torras Tramways Co., Ltd., for an electric tramway in Valparaiso; and by the Buenos Aires, Villasana and Lo Prado Districts Tramway and E.L. Co., Ltd., for electric tramways and lighting in the districts named.

A concession has been granted to Sr. Roberto Araya for the establishment of electric tramways for the transport of merchandise and goods in Valparaiso.—*B. of T. Journal.*

Continental Notes.—GERMANY.—The Senate of Lübeck has introduced a Bill for the expenditure of £97,900 on the construction of an electric railway between that city and Travemünde, a distance of 18 km., which, notwithstanding some opposition on the part of a section of the citizens, is expected to be passed.

ITALY.—La Société des Tramways Toscans has secured a concession for the construction and working of an electric tramway between Carrara and Marina.

Work is about to be commenced on the electrification of the railway between Milan and Gallarate.

SPAIN.—It is announced from Madrid that a company is being formed to construct a system of electric tramways in the province of Tarragona.

Plans are being prepared in respect of an electric railway between Vinaroz and Benicarlo.

RUSSIA.—It is reported from St. Petersburg that a project for the construction of an electric railway between that city and Miedny Sawod is at present under consideration.

Dewsbury.—The B. of T. has sanctioned the borrowing of £1,000 for laying a double line of tramways in Wakefield Road. The Corporation has decided that it cannot entertain the terms quoted by the Yorkshire (W.D.) Electric Tramways, Ltd., with respect to the laying of tramways to Dewsbury Moor.

Gateshead-on-Tyne.—The Town Improvement Committee has reported that the N.E. Railway Co. intends to promote a Bill for powers to run trolley vehicles across the high-level bridge between Gateshead and Newcastle-on-Tyne, and to the Gateshead West Station. The Committee is to report to the T.C. on the matter.

Halifax.—The T.C. has approved of an increase of wages of tramway drivers and conductors; the estimated cost is £900 per annum.

Kearsley.—The Clifton P.C. and the Barton-upon-Irwell R.D.C. have informed the R.D.C. of their willingness to support the Council in the suggested appeal to the Swinton and Pendlebury D.C. with reference to the connecting-up of the South Lancashire Tramways Co.'s tramways and the Salford tramways at Newtown, Clifton.

Lancashire Tramway Arbitration.—Arbitration proceedings have taken place in London, before Mr. Ram, K.C., in connection with the claim by the Colne and Trawden Tramways Co., amounting to £171,586, for the sale of their undertaking to the Colne Corporation. Mr. Harry England intimated the total value of the undertaking at £168,840.

Leyton.—The tramways manager has provisionally arranged with the manager of the West Ham tramways to terminate the existing arrangement as to the running of cars in Forest Road and Dames Road, and for a new arrangement to be entered into. The receipts earned are to be pooled, West Ham to have 9·6d., and Leyton 7·75d. per car-mile.

Liverpool.—MERSEY TRAFFIC FACILITIES.—The receipt of the report of Mr. C. W. Mallins in regard to tramway traffic problems gave rise to a discussion at the meeting of the City Council on the proposal for providing increased facilities for cross-river traffic. Sir Harmood Banner, M.P., moved that a committee be appointed to confer with representatives of Birkenhead, Wallasey and Bootle, the rating authorities and the Mersey Docks and Harbour Board, with a view to adopting a joint contribution by rates for the purpose of improving the means of transit across the Mersey, either by bridge or tunnel. He expressed the opinion that the bridge or tunnel would have to be worked without, at any rate, anything in the shape of a toll. The rateable value of the whole of the districts which, in his opinion, ought to contribute was about £7,000,000. After considerable discussion, the resolution was approved in the following terms:—"That a committee be appointed to confer with representatives of the adjoining boroughs, rating authorities and the Mersey Docks and Harbour Board, to consider the question of improving the means of transit across the Mersey, either by bridge or tunnel." A special committee was appointed, and the Wallasey T.C. has also appointed three members to attend the conference.

London.—The South-Western Co.'s locomotive men at a meeting on Sunday last passed a resolution deploring the decision of the company not to guarantee exclusively for locomotive men the positions of motor men in connection with the forthcoming electrification scheme, and pledging support to the demand, if necessary, by withdrawing labour.

ELECTRIC P.O. VEHICLE.—Some trials are being made by the G.P.O. with an Edison battery van for delivery purposes in the London area.

Morocco.—A company has been formed with the title La Sociedad Anglo-Franco-Espanola, with the object of constructing electric tramways in Tangiers.

Nelson.—RAILLESS TRACTION PROPOSALS.—The T.C. has appointed a Sub-Committee to consider the question of the provision of railless traction for the higher portion of the town.

Northampton.—NEW CARS, PLANT, &C.—The Corporation has decided to adopt a new design of car, with covered top and vestibules. A Sub-Committee is to obtain tenders for these and also for the generators, battery and other plant and the erection of the car-shed. The revenue from the tramways for November 24th to December 15th, 1913, was £1,605. The traffic return from April 1st to November 7th showed the receipts to be £20,402, as compared with £19,033 in 1912, an increase of £1,369.

Pontefract.—The Wakefield and West Riding Tramways Co. proposes to double the whole of its track between Normanton and Pontefract.

South Shields.—TRAMWAY EXTENSION PROPOSAL.—The Tramways Committee has submitted a report on a proposal to provide a riverside route at an estimated cost of £17,260. It is pointed out that this would mean two parallel routes, and it is suggested that a motor-'bus service for the district be adopted. Three 'buses would be required, at about £800 each. The Committee recommended the T.C. not to entertain the proposal to extend the tramways, and this was confirmed.

Tasmania.—The report of the Launceston municipal tramways for the year ended July 31st, 1913, shows that the total number of passengers carried was 2,169,645; the car-miles run, 327,565; and the total revenue, £17,127, an increase of £2,344 over the previous year's figures. The working expenses, after payment of interest, sinking fund, &c., were £10,383, or £2,191 above the previous year. The total revenue of the lighting plant for the year amounted to £21,666, an increase of £1,590. The net profit, after making all allowances, was £5,676.—*Commonwealth Engineer.*

U.S.A.—ELECTRIC VEHICLE CHARGES.—From an investigation recently made by the American Electric Vehicle Association, it appears that the average charge for the supply of energy for charging the batteries of electric vehicles in 91 towns in the United States is 1·5d. per KW.-hour in the case of public garages, and 2·6d. for private (single-car) garages.

Wallasey.—PROPOSED LOAN.—The Council has been recommended by the Tramways Committee to apply for sanction to borrow £10,000 for the erection of tramway workshops and the provision of the necessary machinery.

Westhoughton.—The U.D.C. has informed the South Lancashire Tramways Co. that it would be glad to confer with the company, with a view to connecting the tramways from Hindley to Hulton Lane Ends through Westhoughton.

TELEGRAPH and TELEPHONE NOTES.

India.—Wireless telegraph stations are approaching completion at Peshawar and Quetta. One is also in course of construction at Madras

Portsmouth.—On Tuesday the T.C. adopted a recommendation that the Corporation telephone undertaking be transferred to the Government for £35,000. The system was started in 1903, and now comprises 1,899 subscribers and 2,528 telephones. The Post Office has undertaken that there shall be no increase in cost to the subscribers until there is a revision of the whole of the traffic. It has also agreed to take over the staff.

Spain.—The P.M.G. has agreed to grant a licence for wireless commercial service between England and Spain by way of the Marconi station at Poldhu

Telephone Messages.—The Postmaster-General is said to be considering the feasibility of adopting an arrangement by means of which a telephone subscriber, on payment of a small annual charge, may have messages from callers who ring up during the subscriber's absence from home taken down by the operatoriat the exchange and forwarded on his return. The system is in operation in France.

Wireless in Geodesy.—As the result of protracted observations conducted between the Eiffel Tower in Paris and the Government station at Arlington, U.S.A., it has been ascertained that the difference in longitude between those stations is 279 ft. greater than had been supposed. The stations are 6,175 km. apart, and the time occupied by the wireless signals in traversing this distance twice is estimated at 0·063 second.

Wireless Telephone Frauds.—The *Times* correspondent in New York states that James Dunlop Smith has been sentenced to 18 months' imprisonment and a fine of £1,000, and Elmer Burlingame to 2½ years' imprisonment and a fine of £2,000, for conspiring to swindle investors in the stock of the Radio-Wireless Telephone Co. on a large scale.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—January 31st. Corporation. Four double-deck tramcars. See "Official Notices" to-day.

Accrington.—Corporation. Two double-deck top-covered tramcars, and three single-deck tramcars, complete. See "Official Notices" to-day.

Australia.—SYDNEY (NEW SOUTH WALES).—March 18th. For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" to-day.

February 2nd. Municipal Council. Transformers and weather-proof switch fuses. Specifications (10s. 6d. in each case) from the City Electrical Engineer.

March 2nd. Sydney Harbour Trust. Circular Quay. Three electrically-operated semi-portal travelling cranes for Berths Nos. 1, 2 and 3, Woolloomooloo Bay. Particulars from Engineer-in-Chief of the Trust.

March 25th. N.S.W. Railways and Tramways Department.—Five 1,000-KW. sub-station units to specification No. 124. Particulars at Electrical Engineer's Office, 61, Hunter Street, Sydney.—*Tenders.*

ADELAIDE.—February 11th. P.M.G. 50 cable terminals. See "Official Notices" January 9th.

MELBOURNE.—January 24th. Corporation. House cut-out boxes and replacement wedges.—January 21st. 5 tons, 16 cwt. bare hard-drawn copper cable. See "Official Notices" January 9th.

February 17th. P.M.G. Cable boxes. See "Official Notices" January 9th.

April 7th. For the Postmaster-General. Relays, non-polarised, Stores Schedule 996. See "Official Notices" to-day.

HOBART.—March 2nd. For the Postmaster-General. Telephones, common battery, wall pattern, and table pattern, Schedule T 104. See "Official Notices" to-day.

Belfast.—January 28th. Harbour Commissioners. Electric cables. See "Official Notices" January 9th.

Belgium.—January 20th. The municipal authorities of Farciennes (province of Hainaut). Establishment of a central electric lighting station and a network of mains in the town.

February 17th.—The Société Nationale des Chemins de Fer Vicinaux, of Brussels (14, Rue de la Science). Armoured underground and sub-river feeders required in connection with the Brussels-Haecht local electric railway.

Bradford.—January 22nd. Corporation. Surface condensing plant for 5,000-KW. live-steam turbo-generator. See "Official Notices" January 9th.

The Principal of the Technical College (Prof. G. F. Charnock) is to obtain tenders for driving motors for the engineering workshop, mechanical laboratory and testing rooms. Prof. G. F. Charnock, Principal, Technical College, Great Horton Road, Bradford.

Brentwood.—January 17th. Petrol-driven electric lighting plant (50 lights) for Branch Asylum, Harold Court, Harold Wood. See "Official Notices" January 2nd.

Canada.—WINNIPEG.—January 29th. The *Canadian Engineer* states that tenders are invited for electrically-operated switching apparatus and accessories for the King Street sub-station. Plans, &c., from the Light and Power Department, 54, King Street, Winnipeg.

Cheltenham.—January 31st. Corporation. Twelve months' supply of electric light fittings, and other stores. Particulars from Mr. J. S. Pickering, Borough Engineer, Municipal Offices.

Croydon.—January 26th. Corporation. Stores for Tramway Department. Tramway Manager.

Dundee.—January 30th. Corporation. (*a*) 5,000-KW. steam turbine and alternator; (*b*) condensing plant; (*c*) 750-KW. rotary converter, with transformer. See "Official Notices" Jan. 2nd.

France.—January 15th. The French State Railway authorities (Service Electrique) in Paris (43, Rue de Rome.) Establishment of an electricity generating station at Dieppe.

Ipswich.—January 31st. Corporation. (*a*) Three-phase 300-K.V.A., 3,300-volt alternator, rotary converter with transformer, A.C. booster and D.C. exciter, automatic voltage regulator and booster, cable connections. (*b*) Three 50-K.V.A. three-phase transformers. (*c*) H.T. three-phase main switchboard. (*d*) H.T. and L.T. switchgear. (*e*) Two motor or rotary converters, each 250 KW. See "Official Notices" January 2nd.

Italy.—January 23rd. Italian Ministry of Marine. Electric lamps and electroliers. Upset price (£5,200); deposit 10 per cent. Foreign manufacturers allowed to compete. Tenders to: Al Sig. Direttore Generale dei Servizi Amministrativi, Ministero della Marina, Rome.

Kirkcaldy.—The Corporation Tramways and Electric Lighting Committee has decided to purchase four additional tramway cars.

Leeds.—The City Council has decided to extend the tramway overhead equipment from Moor Top, Farnley, to the city boundary at Drighlington, and to obtain tenders for the work; also to purchase eight trolley vehicles for the purpose of enabling it to carry out the agreement with the Morley Corporation as to the running of through trolley vehicles.

Leigh (Lancs.).—January 23rd. Corporation. One 1,500-KW. turbo-alternator (impulse type turbine), 1,000-KW. rotary converter, transformers and switchgear. See "Official Notices" Jan. 9th.

London.—L.C.C.—January 20th and 21st. Installations at Vernon Square Elementary School, Finsbury, E.C. (241 wiring points and 318 lights), and at Raneleigh Road Elementary School, Pimlico, S.W. (210 wiring points, 258 lights). See "Official Notices" Jan. 2nd.

January 27th. 584 tons of special section rolled steel bar for magnetic brake shoes. Chief Officer, L.C.C. Tramways, 62, Finsbury Pavement, E.C.

ISLINGTON.—January 28th. Corporation. Twelve months' supply of electrical and engineers' stores. See "Official Notices" January 2nd.

ST. MARYLEBONE.—February 11th. Corporation. Underground cables, house cables, flexible cords, rubber goods, box compound and insulating materials, &c. See "Official Notices" January 9th.

KENSINGTON.—January 29th. Board of Guardians. Electric lamps and fittings and other stores. Specification, &c., from Mr. W. R. Stephens, Guardians' Offices, Marloes Road, Kensington, W.

Manchester.—January 20th. (*a*) Tramcar trucks; (*b*) motors and controllers for tramcars. Mr. J. M. McElroy, General Manager, Corporation Tramways.

January 27th.—The Corporation Tramways Committee invites tenders for extensions and alterations at the Hyde Road car-shed. J. Gibbons, architect, 4, St. Mary's Parsonage, Manchester.

Plymouth.—January 19th. Corporation. Twelve months' supply of arc lamp carbons, electricity meters, transformers, cables, &c. See "Official Notices" January 2nd.

Pontypridd.—January 19th. Complete electric light, telephone and fire alarm installation, workhouse, for the B. of G. A. L. Thomas and G. S. Morgan, architects, Gelliwastad Road, Pontypridd.

Sheffield.—February 3rd. Corporation. Contract No 111. Structural steelwork for carrying coal shoots, coal bunkers and railway sidings over same at Neepsend. See "Official Notices" to-day.

South Africa.—The current issue of the *British and South African Export Gazette* refers to the following openings for electrical business:—"Orders for plant and other equipment may be anticipated in view of the proposal to establish a power station and chemical factory on the property of Henderson's Transvaal Estates Co. Valuable contracts for electrical machinery and material will shortly be given out by the Graaff-Reinet Town Council in connection with the electric lighting scheme now authorised. The Pietersburg (Transvaal) Municipality is in the market for material for the new electric lighting scheme. Tenders will shortly be invited by the Municipality of Heidelberg, Transvaal, for machinery and material for an electric lighting scheme. With reference to the call for tenders for gas-electric plant by the Durban Municipal authority, the date for receiving these has been extended to February 4th, and they should be addressed to the Town Clerk, Municipal Buildings, Durban. The London agents for the Municipality are Messrs. Webster, Steel and Co., 5, East India Avenue, London, E.C. Tenders for the supply of 15,794 tungsten filament incandescent lamps are invited by the South African Railways Administration, and will be received up to the 27th inst."

Spain.—The municipal authorities of Bollublos de la Mitacion (province of Seville) have just invited tenders for the concession for the electric lighting of the town during a period of 20 years.

Stockport.—January 19th. The Corporation Tramways Committee invites tenders for one overhead equipment motor-driven tower wagon. R. Lomax, tramway electrical engineer, Millgate, Stockport.

Turkey in Asia.—March 14th. Forty years' electric lighting concession for Trebizond municipality. Population 50,000 to 60,000; 12 miles of street lighting. Houses mostly occupied by poorer classes. Water power (Deirmen River) available. An English translation of the conditions may be seen at the Board of Trade Commercial Intelligence Department in London.

West Hartlepool.—January 21st. Corporation. Tramway employés' uniforms, tramway tickets. See "Official Notices" January 9th.

Wolverhampton.—January 19th. Corporation. Two water-tube boilers complete with superheaters and mechanical stokers. See "Official Notices" January 2nd.

CLOSED.

Aberdeen.—The Board of Trade has offered no objection to the permanent use of the "pay-as-you-enter" type of cars, and having examined tenders received for the construction of six new double-deck cars of this type, the Tramways Committee recommended the acceptance of the offer of the Brush Electrical Engineering Co., Ltd., being the lowest, and amounting to £2,490. The Town Council approved of the recommendation, it being stated in the course of the discussion that the local offerers' tender was £1,000 above the one accepted.

Aldershot.—The U.D.C. has accepted the tender of the British Petroleum Co., Ltd., for the supply of fuel oil (10 to 11 tons) for the Diesel engine at the electricity works, at £3 16s. 8d. per ton.

Australia.—The following tenders have been accepted by the Postmaster-General's Department:—

NEW SOUTH WALES:—
380 cable boxes, £558.—C. Glasson.

VICTORIA:—
100 cable boxes, £140.—W. T. Henley's Telegraph Works Co., Ltd.

WESTERN AUSTRALIA:—
80 common battery telephones, with generators, £85: 50 ditto., £121; 150 single translators, £67.—Western Electric Co. (Aus.), Ltd.
20 cordless, 10-line, magnetic switchboards, £170.—J. Bartram & Son, Pty., Ltd.
4 miles silk and cotton-insulated, light lead-covered switchboard cable, £407.
Messrs. Dalgety & Co. have secured contracts for pattern "A" porcelain insulators as follows:—New South Wales (1913-14), 156,000, £3 778; (1914-15), 62 000, £3,923. Queensland (1913 14), 78 000, £1,920; (1914-15), 78,000, £1,920. South Australia (1914-15), 27,000, £672. Tasmania (1914-15), 12,000, £297.—*Tenders.*

Ballater, N.B.—The contract for wiring for electric light installation at the Victoria and Albert Halls, Gordon Institute, Post Office, &c., has been placed with Messrs. T. C. Smith, electrical engineers, Aberdeen.

Belgium.—Six concerns, five German and one Belgian, submitted tenders last week to the Belgian Post and Telegraph authorities for the supply and laying of a quantity of telephone cables in the Brussels district, the lowest offer being that of the A.E.G. Union Electrique Co., of Brussels.

Bournemouth.—The T.C. has accepted the tender of the British Westinghouse Co., Ltd., for arc lamps, &c., for lighting the Undercliffe Drive, at £499.

Burnham.—Mr. H. Young, of Brent Knoll, has secured the contract for trench work in connection with the electric lighting system of the town.

Bradford.—The City Council has accepted the following tenders:—

Brown, Muff & Co., Ltd.—Uniform clothing for electricity department inspectors.—30 jackets, £1 8s. 11d. each: 30 waistcoats, 7s. 9d. each; 60 pairs of trousers, 15s. 9d. per pair; 30 caps, 2s. 11d. each.

The Corporation Street Improvements and Buildings Committee has accepted the tender of Messrs. Rawlinson, Ltd., to erect two electric lifts and an electric crane for a new warehouse at Dumb Mill for £775. The Tramways Committee has accepted the tender of the Daimler Co., Ltd., for a 40-H.P. petrol motor lorry, for the Permanent Way Department, at £788.

Bury.—The Corporation has sealed contracts as follows:

J. Baker & Co.—Axles.
Walter Scott, Ltd.—Steel rails.
R. Dempster & Sons, Ltd.—A vaporiser.

Cape Town.—The electric lighting contract for the South African Industrial Exhibition, to be held in Cape Town from February 2nd to 28th, has been placed with Messrs. E. A. Shaw and Co., of Cape Town. The contract also includes wiring for, and erection of, motors for machinery in motion.

Colliery Plant.—Messrs. Johnson & Phillips, Ltd., have in hand for Halls Collieries, Ltd., a 3,000-volt overhead line for transmitting power to colliery, with two sub-station equipments, transformers, shaft cables, &c.

Ealing.—The T.C. has accepted the tender of Mr. W. J. Dickens, at £100, for wiring the Town Hall extension.

Keighley.—Messrs. Clough, Smith & Co., Ltd., have secured from the Cedes Electric Traction Co., Ltd., the contract for the erection of the overhead equipment of the Keighley Corporation trackless extensions, a length of 7 miles, at an average contract rate of £923 per route mile. This firm also carried out the first section of the Keighley trackless system, a route length of 1 mile 1,400 yards.

London.—The Metropolitan Water Board has accepted the tender of the General Electric Co., Ltd., at £339, for the supply of a Belliss & Morcom "Witton" high-speed engine and dynamo, generating panel, fittings, &c., required in connection with the installation of electric light at the Surbiton station.

The Port of London Authority has accepted the tender of the British Westinghouse Electric and Manufacturing Co. for three 1,000 KW. rotary converters. The same authority has also accepted a tender for the supply of 600 dozen dry batteries for the electric torches adopted some time ago for the dock police.

BATTERSEA.—The B.C. has accepted the tenders of W. Morgan, the Alpha Manufacturing Co., and Arthur Newman, Ltd., for the installation of arc and metallic lamps on consumers' premises under the Council's hire scheme.

HACKNEY.—The B.C. has accepted the tender of Messrs. Rice and Son, of Stockwell Road, S.W., for the erection of three electricity sub-stations at Northwold Road, Dalston Lane, and Balcorne Street, amounting to £9,210.

Lossiemouth.—The T.C. has placed a contract with Messrs. Johnson & Phillips, Ltd., for complete generating station equipment, including dynamos, booster, battery, switchboard and cables.

Manchester.—The Electricity Committee has accepted the following tenders:—

Chloride Electrical Storage Co, Ltd.—Supply and maintenance of a traction storage battery at Dickinson Street station.
Lancashire Dynamo and Motor Co., Ltd.—Reversible booster, regulator, and switchgear for the traction storage battery (switchgear sublet to Mr. Bertram Thomas).
British Westinghouse Co., Ltd.—Two 800-KW rotary converters.
Electrical Engineering and Equipment Co., Ltd.—Cable.
Siemens Bros. Dynamo Works, Ltd.—Two 500-K.V.A. static transformers.

The Tramways Committee has accepted the following:—
Ransomes & Rapier, Ltd.—Wagon turn-table for Hyde Road Permanent Way Department
Stedman, Crowther & Co.—Block tin.
Tangyes, Ltd.—Car wheel tire turning lathe.

For route number boxes:—
Till & Whitehead, Ltd. Metal fittings.
Equipment & Engineering Co., Ltd.—Route number plates.
Drake & Gorham, Ltd.—Metallic filament traction lamps.

Northampton.—The Tramways Committee has decided to recommend the Council to expend £25,677 on the undertaking, £20,352 of which is for extensions, &c., and the remainder for new cars. The following tenders were received for the extension to Far Cotton, and for doubling a large part of the Kingsthorpe route:—

Stark, Ltd., Glasgow	£20,353
Pearce, Ltd., Morecambe	20,613
A. Fidler, Borough Engineer, Northampton	20,922
Geo. Law, Kidderminster	21,319
G. P. Trentham, Birmingham	21,486
Foster, Ltd., Liverpool	22,490
Dick, Kerr & Co., Ltd., Preston	22,571
Clough, Smith & Co., London	23 409
Gr fiths, Ltd., London	24 086
A. A. Clarke, Northampton	24 885
R. Finnegan, Northampton	25,408
Wimpey & Co., London	26,209

The tender of Messrs. Stark was recommended for acceptance. The borough engineer was directed to tender, but the Committee was in favour of the lowest tender in preference to direct labour. The Committee recommended that seven new cars be purchased from the Brush Electrical Engineering Co., at £761 each, the cars to have Dick, Kerr & Co.'s electrical fittings.

Middleton.—The Electricity Committee has accepted the tender of Messrs. Adam Lee & Co. for 150 tons of Bulcroft washed slack.

Rathmines.—The U.D.C. has accepted the tender of the British Westinghouse Co. for a dynamo for the electricity undertaking, at £1,003. An amendment to accept another tender for £700 odd was lost. Mr. Beater said that the Committee went very carefully into the matter, and found that the other firm had only manufactured such large machines in one or two instances, and over a period of two years, whereas the Westinghouse Co. had made these machines for over 20 years. The chairman said that the Committee sent the engineer to inspect various machines, and they came to the conclusion that they would be wrong in accepting any other tender than the Westinghouse one. Mr. Standing said that the Committee received between 30 and 40 tenders, rising from £600. Among five or six selected by the engineer was that for £700. The matter which influenced the engineer in his final recommendation was the name and reputation of the Westinghouse Co. He could find no fault with the specification of the other firm. The young firm ought to be given a chance where there was a difference of £300 in £1,000, and a 12 months' guarantee was given with the £700 tender. The amendment was defeated, and the tender of the British Westinghouse Electric Manufacturing Co. accepted.

Rotherham.—The T.C. has accepted the tender of Chadwick & Co., at £6,755, for extensions to the tramcar sheds.

Sheffield.—The following tenders have been accepted by the T.C. :—

R. White & Sons.—Extending coal-handling aerial ropeway at Neepsend power house, £355.
W. Marlow & Sons.—Foundations for three boilers, base of chimney stack, and two fan houses, at Neepsend, £2,403.
J. E. Nadin.—Excavating additional land for storage of coal at Neepsend, £289.

The City Council's contract with Messrs. A. Reyrolle & Co., Ltd., for a supply of 14 panels of E.H.T. sub-station switchgear is to be extended to provide for a further 14 panels at the same price, viz., £1,682.

Southport.—The Electricity Committee has accepted the tender of the British Westinghouse Electric and Manufacturing Co., Ltd., amounting to £1,920, for the supply of an alternator.

Stockport.—The Corporation Electricity Committee has accepted the tender of Messrs. John Spencer, Ltd., for wrought-iron steam pipes, at £39 10s.

The Tramway Committee of the T.C. has accepted the tender of the Leeds Steel Co., Ltd., for B.S.S. No. 4 tram rails, at £6 15s. per ton.

Walsall.—The following tenders have been accepted by the T.C. for annual supplies to the Tramways Department :—

Anti-Attrition Metal Co., Ltd.—Trolley wheels.
J. W. Caparn.—Malleable iron castings.
Dyer & Young.—Controller fingers.
A. Goldie Engholm.—P. & B. tape (1 in.) and Blackley tape (1 in.).
Edison & Swan United Electric Light Co., Ltd.—Dry cells.
Electric and Ordnance Accessories Co., Ltd.—Arc lamp globes and carbons.
Fleming, Birkby & Goodall, Ltd.—Strand wire.
J. North Hardy & Son.—Linen frame tape and linen tape.
Glacier Anti-Friction Metal Co., Ltd.—Anti-friction bearing metal.
Heap & Johnson.—Carbon brushes.
National Rail and Tramway Appliances Co., Ltd.—Brake blocks.
Siemens Bros. & Co., Ltd.—Tantalum lamps.
Alfred Wiseman, Ltd.—Pinion wheels, mechanical cars, &c.

West Ham.—The T.C. has made arrangements with Messrs. W. Cory & Son, Ltd., whereby their contract for a supply of coal to the electricity department will be extended for a further year from March next. The estimated amount required during the year will be approximately 60,000 tons.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week :—

Monday, January 19th.—"A" Company. Technical instruction, 7 to 10 p.m.
Tuesday, January 20th.—"B" Company. Technical instruction, 7 to 10 p.m.
Wednesday, January 21st.—Recruits only. Infantry drill and technical instruction, 7 to 10 p.m.
Thursday, January 22nd.—"C" Company. Technical instruction, 7 to 10 p.m.
Friday, January 23rd.—"D" Company. Technical instruction, 7.30 to 9.30 p.m.
Saturday, January 24th.—Headquarters will be opened for regimental business only from 10 a.m. till 12 noon.

(Signed) F. R. HOLT-WHITE, Capt. R.E., Adjutant,
For Officer commanding L.E.E.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Saturday, January 17th. At 7 p.m. At Royal Technical Institute. Presidential Address. Social evening.

Institution of Electrical Engineers (Western Local Section).—Monday, January 19th. At 5.30 p.m. At University of Bristol (Merchant Venturers' Technical College). Paper on "The Employment of Power in H.M. Post Office," by Mr. H. C. Gunton.

Junior Institution of Engineers.—Monday, January 19th. At 8 p.m. At Institution of Electrical Engineers, Victoria Embankment. Paper on "Modern Gearing," by Mr. H. H. Thorne.

Institute of Marine Engineers.—Monday, January 19th. At 8 p.m. Paper on "The Corrosion of Iron and Steel Structures and their Preservation," by Mr. F. Crosby-Jones.

Institution of Engineers and Shipbuilders in Scotland.—Tuesday, January 20th. At 8 p.m. At Rankine Hall, 39, Elmbank Crescent, Glasgow. Ordinary General Meeting.

Institution of Civil Engineers.—Tuesday, January 20th. At 8 p.m. At St. George's Street, S.W. Ordinary meeting.
Friday, January 23rd. At 8 p.m. Students' meeting.

Institution of Electrical Engineers (Manchester Students' Section).—Tuesday, January 20th. At 7.30 p.m. At Municipal School of Technology. Paper on "Electro-therapeutics," by Mr. S. D. Anderson.

Institution of Post Office Electrical Engineers.—Tuesday, January 20th. At 6 p.m. At Institution of Electrical Engineers, Victoria Embankment. Paper on "Overhead Wire Construction for Medium and Low Pressures," by Mr A. P. Trotter.

British Electrical and Allied Manufacturers' Association.—Wednesday, January 21st. At 7 p.m. for 7.30. At Savoy Hotel, Victoria Embankment, W.C. Dinner.

Wireless Society of London.—Wednesday, January 21st. At 8 p.m. At Institution of Electrical Engineers, Victoria Embankment. Presidential Address, by Mr. A. A. Campbell Swinton.

Institution of Mechanical Engineers.—Thursday, January 22nd. At 7.30 p.m. At the Medical Theatre of the University, Edmund Street, "Thomas Hawksley" Lecture on "Water as a Mechanical Agent," by Mr. E. B. Ellington.

Institution of Electrical Engineers.—Thursday, January 22nd. At 8 p.m. At Victoria Embankment. Fifth Kelvin Lecture, by Sir O. Lodge, F.R.S.

Chemical Society.—Thursday, January 22nd. At 8.30 p.m. At Burlington House. Ordinary Scientific Meeting.

Physical Society.—Friday, January 23rd. At 5 p.m. At the Imperial College of Science, South Kensington. Ordinary Meeting.

Manchester Association of Engineers.—Saturday, January 24th. At Grand Hotel, Aytoun Street. Paper on "Power Production," by Mr. E. G. Hiller.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, January 24th. At 6.30 p.m. At Armstrong College. Reception until 7 p.m. Annual Dinner.

Association of Mining Electrical Engineers (West of Scotland Branch).—Saturday, January 24th. At 4.30 p.m. At Royal Technical College, Glasgow. Paper on "Specifying and Buying Electrical Mining Plant," by Mr. J. P. C. Kivlen.

THE LONDON ELECTRICAL MASTERS' ASSOCIATION.

MR. L. G. TATE, the secretary of this new Association, has issued the following notice :—

"With reference to the agitation that is now taking place in the electrical industry in Greater London, I beg to inform you that the association of employers called the London Electrical Masters' Association, which comprise companies and corporations supplying electricity, railway companies using electricity, manufacturers of electrical appliances and electrical contractors, is now making a direct appeal to the men by means of the enclosed poster, asking them to appoint delegates to attend a meeting at Caxton Hall on Tuesday, January 27th, 1914, for the purpose of appointing a committee from amongst themselves to confer with the committee of the London Electrical Masters' Association. My Association is extremely anxious that the rights and privileges of men not wishing to belong to any organisation should be strictly preserved, hence the reason of the above proposal. I shall be much obliged if you will give same prominence in your esteemed journal, so as to reach such employers and men whom I cannot get in touch with."

The poster accompanying the letter reads as follows :—

NOTICE.

The London Electrical Masters' Association, being desirous of improving the status of all electrical workers (whether connected with any organisation or not) and the general terms of employment and wages, desire you to send a delegate or delegates to meet them, each delegate representing about 20 men.

At the meeting, which will be held on Tuesday, January 27th, at 8 p.m., at Caxton Hall, all matters with reference to employment will be openly discussed, when it is hoped that a committee of the men and the London Electrical Masters' Association will be formed to draw up a code of working rules, fix a scale of minimum wages and settle other terms of employment.

The delegates to be electrical workers, and the names and addresses of those selected should be forwarded through the employer to Mr. L. G. Tate, secretary of the London Electrical Masters' Association, 20, Bucklersbury, E.C., not later than Monday, January 19th, when admission tickets for the meeting will be forwarded.

We have also received the following letter from the Electrical Trades Union :—

"Dear Sir,—The Committee of the newly-formed London Electrical Masters' Association, consisting of 11 gentlemen who do not, by any means, represent the electrical industry in the Metropolis, but who were delegated by a meeting of some of the employers held at the Institution of Electrical Engineers on December 3rd last, to confer with the Electrical Trades Union, have decided without consulting their constituents not to carry out their instructions.

"They have issued a notice to the trade, which, to say the least, is entirely novel, though somewhat crude in structure, and is a departure from all accepted principles of negotiating with a workmen's association on questions relating to wages and working conditions. This document must have been conceived in the spirit of determination not to foster that industrial harmony which we are told by the employers is so necessary for the well-being of the electrical industry.

"Our position remains that we have been, and are, prepared to meet the employers at a conference, to discuss all matters pertaining to the relations between employer and employé. Providing we have a fair field, we ask no favours.

"The responsibility now rests with the great body of those who have not been consulted. Whether they will accept the ruling of a non-representative oligarchy, whose methods can only cause endless trouble, or will meet the legitimate desires of their workmen for better conditions, which everyone is agreed is their due.

"Thanking you in anticipation for publishing this and the appended letter, which is being circulated to all the employers in the area of Greater London.

"I remain,
"Yours faithfully,
"J. POTTER,
"*District Sec. Electrical Trades Union.*
"32, Chichester Road, Kilburn, N.W.,
"*January 14th*, 1914."

(*Copy of Letter to Employers.*)

"Dear Sir,—Adverting to our letter of November 11th last, in which an application for an advance of wages to electrical grades was made, and in which we stated we were prepared to discuss this question with a body representative of the employers, we have received a communication from the Committee of the newly-formed London Electrical Masters' Association refusing to negotiate.

"The Masters' Association was brought into being on December 3rd at a meeting of the employers as a result of the above application. A Committee was there appointed, with, we understand, definite instructions to meet representatives of the Trade Union. We have been, and are, prepared to meet a body representative of the employers to deal with any points at issue, providing the questions are discussed on their merits, without any previous conditions being exacted by either side. This decision we have communicated to the Committee of the London Electrical Masters' Association. Apparently at the bidding of a small caucus they have refused to accept these perfectly fair terms, without even consulting the opinions of the general body of employers.

"A number of contractors and others have already conceded the rates we ask ; a still larger number have written that they thought our claims justified. In the circumstances, we have no alternative, representing as we do by far the larger section of the skilled workers in the industry, and having waited two months, but to issue the enclosed working rules card, which will become operative on and after Saturday, January 24th, 1914.

"Trusting we shall hear from you that the new terms have received your favourable consideration.

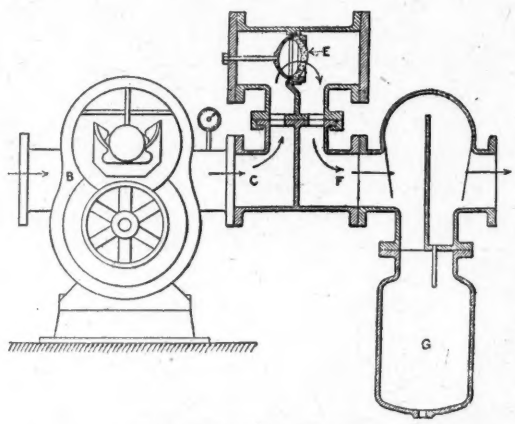
"I remain, on behalf of the London District Committee,
"J. POTTER,
"*District Sec. Electrical Trades Union.*
"*January 14th*, 1914."

NOTES.

Fires which were not Electrical.—When quite recently a large fire resulting in damage to the extent of £80,000 occurred in Bradford, efforts were made to put the entire blame upon the electric plant, but Bradford electrical engineers were able to rebut the allegations that the cables were at fault. Now comes another complaint, this time from Harrogate, where a fire occurred on December 31st, and was at once attributed to the fusing of an electric wire which melted the gas pipes in the building. Mr. George Wilkinson, the borough electrical engineer, at once investigated the matter personally, and found that instead of the electric wires being fused, the only effect of the fire upon them was a blackening of the outer covering of the insulated cables. Otherwise everything was intact. Instead of electricity being the cause of the fire, it was found that there was evidence that the fire had been aggravated by gas escaping from the melted pipes, and Mr. Wilkinson suggests that it would be safer in buildings where such a dangerous commodity is used if the Government would insist on the use of wrought-iron pipes in place of lead ones.

New Process of Cleaning Producer Gas.—Mr. H. F. Smith recently communicated to the American Society of Mechanical Engineers a new method of removing the mechanical impurities present in producer gas from bituminous coal. The apparatus is shown below. The gas on leaving the producer is first cooled to a point where the tar vapours are condensed by being passed through a primary cooler or condenser. From this the gas is carried into an ordinary rotary gas pump B which delivers the gas under pressure into the main C; it is then delivered through a porous diaphragm E and discharged from there into the main F. A sump or separator G is provided in which the tar accumulates.

The diaphragm E is made of spun glass in the form of ordinary glass wool (not slag wool) built into the form of a uniform diaphragm and retained between two metal screens. Ordinarily, this



STATIC SCRUBBER LAYOUT.

diaphragm is made up to a thickness of approximately one-quarter of an inch. About 400 cb. ft. per hour can be handled for each square inch of diaphragm area. No tar is retained in the diaphragm, both tar and gas being discharged together.

In passing the diaphragm an important change in the physical state of the tar occurs. On the entering side the tar exists in a large number of minute particles, ordinarily known as tar fog. In passing the diaphragm these particles are caused to coalesce, so that on the discharge side the tar particles are of relatively large dimensions, so large in fact that they can no longer be carried forward in the gas current and immediately separate out by gravity. All that is necessary for the complete separation of the tar from the gas is to provide a sump, or drip, into which the precipitated tar can drain.

It appears to be possible to secure almost any desired degree of gas cleanness simply by regulating the pressure maintained across the diaphragm. In ordinary commercial operation, it is found that a difference in pressure of from 2½ to 4 lb. will give a degree of gas cleanness that is ample for any commercial requirement; 30 cb. ft. of gas cleaned in this way can be passed through a white filter paper without producing any discoloration.

Good results can be secured only when the velocity of the gas passing through the diaphragm is very high. Nothing whatever remains in the diaphragm.

No water is used in connection with this process except that required to cool the gas. The tar is practically water free.

It is believed that in addition to the effects of mechanical collision which undoubtedly exist, there is some electrical action which is of material aid in causing the coalescence of the particles of tar fog.

The first commercial equipment of this kind has now been in continuous operation for approximately 18 months, handling gas for a producer-gas power plant of approximately 1,000 H.P. capacity.

Foreign Trade in December.—The following are the electrical and machinery figures given in the official returns for December trade, and for the entire year 1913 :—

IMPORTS.	*Month of Dec.* £	*Inc. or dec.* £	*Twelve months,* 1913. £	*Inc. or dec.* £
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	155,547	+18,083	1,587,318	+129,675
Machinery	617,884	+ 3,265	7,282,046	+461,363
EXPORTS.				
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	346,464	+ 26,345	5,404,671	+1,063,084
Machinery	2,957,456	+214,122	37,027,582	+3,869,567

Appointment Vacant.—Electrical testing assistant (32s. 6d.), for Salford Corporation. Particulars are given in our advertisement pages.

Inquiries.—Makers of Edison screw lampholders in this country, and makers of Raise's light regulating switches (Patent 5,521, 1911), are asked for.

Electricity Supply Rifle League.—The following are the results of matches shot during December:—Brompton (Mugford, Willis, Nash, 98), 578, *v.* St. James's (Young, 95), 552; Brompton (Beale, 96), 561, *v.* Shoreditch (Foster, 97), 559; Central (Gaze, Wells, 98), 573, *v.* St. James's (Young, 99), 544; Central (Gaze, 100), 578, *v.* Stepney (Dubbin, Graves, H. A. Mansell, 88), 514; Hackney (Barham, 92), 521, *v.* Ilford (Brown, Haeger, L. and R. Tufnell, 96), 569; Hackney (Hilling, 99), 552, *v.* Stepney (Dubbin, 90), 489; Ilford (Haeger, 97), 561, *v.* Westminster (Partridge, H. Pearman, 98), 571; Poplar (Hogg, 93), *v.* Shoreditch (Weekes, 99), 568; Poplar (Randall, 97), 560, *v.* Westminster (H. A. Pearman, 97), 564. The following is the final position of the clubs:—

	Matches.					Scores.		
	Shot.	Won.	Lost.	Drwn.	Pnts.	For.	Agnst.	Avge.
Westminster	16	14	2	0	28	9,098	8,783	568·62
Central ...	16	12	3	1	25	9,051	8,728	565·69
Ilford ...	16	12	4	0	24	9,033	8,735	564·56
Shoreditch	16	11	4	1	23	9,073	8,792	567·06
Brompton	16	10	6	0	20	8,989	8,766	561·81
St. James's	16	6	10	0	12	8,693	8,895	543·31
Hackney	16	4	12	0	8	8,709	8,748	544·31
Stepney ...	16	2	14	0	4	8,526	8,773	532·87
Poplar ...	16	0	16	0	0	8,027	8,979	501·69

Fatalities.—TRAFFORD PARK.—On Thursday, last week, an inquest was held by County Coroner Sellus into the cause of the death, which occurred at the Westinghouse Works, Old Trafford, Manchester, on the previous Monday, of Thomas Henry Spokes, 42, of 20, Grosvenor Road, Urmston, a fitter.

Mr. Mensforth, the works manager, said there was an electric motor used for driving the fly-wheel, and the object of the wheel was to compensate for irregularities. The winding motor required a heavy current, the supply being taken from the Supply Co. It was a very fluctuating demand, and the Supply Co. objected to such a demand. The fly-wheel was to act as an accumulator and to flatten out this supply from the mains.

Evidence was given to show that the fly-wheel had burst, and deceased was killed and 12 others injured.

Mr. Griffiths said he had worked on the fly-wheel for a week, and had got it to a speed of 1,100 revolutions; it was guaranteed to run at 1,200. It was 8 ft. in diameter and weighed 4½ tons. They were balancing it when it burst.

Mr. H. M. Seal, H.M. Inspector of Factories, said they had sought for a cause of the accident, and they considered the design of the wheel was satisfactory, and that the electrical portion of the machine was mechanically the weaker, and would have shown signs of distress considerably below the point at which the fly-wheel should have burst; but when they considered the strains that might be in the fly-wheel, due either to want of proper annealing or improper cooling in the manufacture, they came to the conclusion that the undoubted reason for the failure was that the rim of the fly-wheel had an initial tension in it due to the fact that it had not been properly cooled.

The Coroner: Do you suggest that there was negligence in the making of the wheel?—Mr. Seal: I would not say that the firm should be certain as to the length of time a wheel was allowed to cool. The Coroner: In your opinion there has been no gross negligence on the part of the firm supplying the wheel?—Mr. Seal: No, I should say there was not. A verdict of "Accidental death" was returned.

An electrician named White, while engaged near the roof of the smelting department in the works of the Clydebridge Steel Co., Cambuslang, overbalanced and fell, receiving fatal injuries.

Manchester Electro-Harmonic Society.—The fourth concert of the season takes place to-night at the Albion Hotel, Manchester, with Mr. Geo. Leyton in the chair. The artistes announced are:—Soprano, Miss Mabel Hirst; bass, Mr. Hamilton Harris; Mr. Ernest Hastings, humour and music at the piano; accompanists, Mr. R. H. Greaves and Mr. W. J. Smith, the hon. musical director. As usual, there will be a number of intervals, and a large attendance is asked for.

Hackney Electric Rifle Club.—A concert promoted by the Rifle Club of the Hackney Borough Council electricity department was held in the Town Hall on Friday evening last, the Mayor (Mr. C. Wimpley) presiding. Mr. F. Heathman, musical director, was presented with a sealskin cigar case in recognition of his services in organising the concert, and Mr. L. L. Robinson, the borough electrical engineer, was awarded a vote of thanks on the initiative of Mr. Beadle, who said that during Christmas week they had to meet a demand of 4,870 KW., with a plant of 4,800 KW., and a staff who could maintain that deserved the thanks of their chief. Cups and prizes were presented for efficiency in shooting.

E.T.B.I.—A circular has been issued by the secretary of the Electrical Trades Benevolent Institution regarding the advantages of membership, who is eligible, &c. The subscription is 10s. per annum, and only those who have been members for at least five consecutive years are qualified to receive pensions. Copies of the circular for distribution among possible subscribers may be obtained from the secretary, Mr. F. B. O. Hawes.

High-pressure Shock.—From Rjukan it is reported that a workman happened to touch a wire from a cable charged with 10,000 volts. The result was a terrible shock, and he lost consciousness, but recovered soon afterwards, and escaped with some burns.

Institution and Lecture Notes.—CITY AND GUILDS TECHNICAL COLLEGE, FINSBURY.—On Monday evenings, commencing on January 26th, at 8 p.m., Mr. J. K. Catterson-Smith, M.I.E.E., is to deliver a special course of six advanced lectures on "The Theory, Calculation, and Operation of Modern Rotary Converters." The fee for the course is six shillings. The programme may be obtained by applying to the College, Leonard Street, E.C. An announcement will be found among our advertisements.

INSTITUTION OF ELECTRICAL ENGINEERS.—At the meeting of the SCOTTISH LOCAL SECTION, held in Glasgow on Tuesday, the paper by Mr. H. C. Gunton on "The Employment of Power in H.M. Post Office" was read and discussed.

A meeting of the MANCHESTER LOCAL SECTION was held on Tuesday last, when the paper by Mr. B. Welbourn on "British Practice in the Construction of High-Tension Pole Lines" was read. An interesting discussion followed, to which Mr. Welbourn replied.

GREENOCK ELECTRICAL SOCIETY.—On Friday last papers were read on "Cable Faults and their Causes," by Mr. L. Hogg, and on "Thoughts on Cable Chemistry," by Mr. Lowrie Sinclair.

BIRMINGHAM AND DISTRICT ELECTRIC CLUB.—At Birmingham on Saturday, Mr. W. Y. Anderson delivered his presidential address to the members. He said that electricity was perhaps the greatest factor which enabled a nation to find a satisfactory solution to the physical and educational problems which it had to deal with; it had done more to benefit health and conditions of labour than years of legislation.

At the meeting of the YORKSHIRE LOCAL SECTION, on Wednesday last, the paper by Mr. B. Welbourn, on "British Practice in the Construction of High-Tension Overhead Transmission Lines," was read and discussed.

INSTITUTION OF CIVIL ENGINEERS.—At the Students' meeting, on Friday last, Mr. C. I. Routh read a paper entitled "The Application of Power Railway Signalling in Great Britain."

The New Switchgear Rules of the V.D.E.—For the benefit of those who have not had an opportunity to study these Rules (which were discussed in our issue of January 2nd) the following short description is given:—

The title runs as follows:—"Preliminary Standards of the V.D.E. for the Design and Testing of A.C. H.T. Apparatus of a rated Voltage from 1,500 Volts upwards." It is also stated that these Rules are to come into force on January 1st, 1914. There are 32 Rules and an Appendix.

The first seven are general Rules, and deal with the standard voltages and currents, the rating of oil switches, the tables commented on in our article and two or three minor points.

Rules 8 to 25 relate particularly to oil switches, and those which are of special interest are dealt with in the article.

Rules 26 to 28 refer to isolating switches, and contain one unusual provision, viz., that this type of switch is only admissible in oil up to 6,000 volts. There seems to be no technical reason for this.

The next four Rules, Nos. 29 to 32, relate to apparatus for overhead transmission lines up to 35,000 volts, and are set forth in a manner with which we are all familiar.

The appendix consists of numerical examples showing how to select the correct size of oil switch according to the tables given under Rule 5, and it has been attempted in the article to translate these examples into a diagram, as shown in fig. 2.

The following errata occurred in the article:—Page 6, col. 2, line 50, for agreed, read argued; page 7, col. 1, line 5, for number, read numbers.

Under Rule 20.—If the time in which the relay acts is taken at 1½ seconds, the formula becomes $150 \times 1{\cdot}5/t$, and the maximum allowable permanent short-circuit current under the conditions stated is 45 times the normal current.

The author points out that at first sight it would appear that Rule 20 was in opposition to the usually accepted theory by which it is assumed that a time lag increases the breaking capacity of the switch, but this deduction is incorrect, since Rule 20 refers particularly to the effects on the switch contacts of the heat generated by heavy overloads, and the figures presumably are so chosen as to reduce the risk of serious burning or welding. When the current-carrying capacity of a switch is within the limits given above, it should be safe to assume that a switch fitted with a time-lag would have a greater breaking capacity.

Legal.—CITY OF LONDON ELECTRIC LIGHTING CO., LTD., *v.* TILLINGS, LTD.—In the King's Bench Division on Wednesday, Mr. Justice Horridge, sitting without a jury, heard two actions brought by the City of London Co. against Thos. Tillings, Ltd., the well-known 'bus owners, both actions relating to damage done by the defendant company's motor-'buses to the plaintiff company's electric standards. The accident that formed the subject of the first action happened on April 30th, 1913, at a refuge in Bishopsgate Street, the omnibus knocking down the standard and the lamp on it. The second occurrence was on May 23rd, 1913, a 'bus belonging to the defendants knocking down a large lamp standing on the footway in the Minories. The damages had been agreed, and Mr. Justice Horridge was asked to determine the question of liability. Mr. Justice Horridge, in the first case, took the view that the driver was going too fast, that he lost his head and applied his brakes unnecessarily, and therefore the plaintiffs were entitled to succeed. As to the second case, his Lordship held that the driver of the motor-'bus was negligent in putting on his brakes, especially in view of the expert evidence that a 'bus, if properly managed, would not skid 30 yd. Judgment was entered for the plaintiffs in both actions for £54 5s. 10d. and costs.

Annual Dinners, Socials, &c.—The first annual dinner of the Leyton U.D.C. electric power station employés' Social and Athletic Club was held recently at the Masonic Hall, a company of 50 being present under the chairmanship of Mr. F. Harman Lewis. Messrs. J. W. Speight and L. O. Cox (vice-presidents), and Mr. F. Schofield, tramways manager, were among those present. Mr. J. H. Quicke acted as secretary. The toast of "The Club," proposed by Mr. Cox, was responded to Mr. Whitnell. Mr. W. Matthews proposed "The Presidents and Vice-Presidents." Mr. Harman Lewis, in responding, said that it was 15 years since he first went to Leyton, and with one exception he had seen all the members of the staff come. He wanted to tell them that he did not wish to see any of them go. Rivalry between outdoor and indoor staffs was a good thing if it did not lead to bitterness of spirit. Other toasts followed.

The annual plain, fancy and evening dress dance of the Osram and Robertson Social and Athletic Club is to be held at the Brook Green Works, Hammersmith, W., on Saturday, January 31st, from 7 to 12 o'clock.

Last week the South Lancashire Tramways Co. entertained to dinner at the Leigh Co-operative Hall the whole of their employés, numbering close upon 500. The first party was entertained on the Monday evening, and the second on Thursday. It was announced that a new scale of pay for drivers and conductors, applicable to all except conductors in the first year of their service, had been arranged to come into operation at once, together with other improvements relating to working conditions.

The employés at the Middleton Electricity Works had their annual dinner last week. Councillor Wiggins presided, and others present included Mr. S. Pauls (electrical engineer), and Mr. F. Entwistle (town clerk).

On the invitation of the Hendon Electric Supply Co., Ltd., a dinner was held at Pritchard's Restaurant, Golder's Green, on Wednesday evening, the 7th inst., the chair being occupied by Mr. B. G. Drummond, the manager of the company, supported by Mr. K. A. Scott-Moncrieff, the managing director. After the repast the chairman proposed, and Mr. Harvey, the oldest member of the staff, seconded, a vote of thanks to the company. Mr. Scott-Moncrieff, in replying, paid a tribute to Mr. Drummond, to whom was due the credit of the present position of the company. The party then adjourned to the Golder's Green Hippodrome, where the remainder of the evening was spent. The guests included the following:—Mr. H. M. Sillar, chief assistant engineer, Mr. W. Andrew, assistant engineer, Mr. S. C. Hall, cashier, Messrs. Mason and Clarkson, sales department. On Saturday, the 10th inst., the wives and children of the men were entertained at tea and subsequently enjoyed themselves at the Ionic Theatre, Golder's Green. The arrangements were carried out by Messrs. Hall, Green, Cannon and Stenart, who acted as the Staff Committee.

The staff of the Barnsley Corporation electricity department held their annual charity ball in the Drill Hall, Barnsley, on Thursday, the 8th inst. Coloured electric lamps festooned about the ballroom greatly added to the beauty of the elaborate decorations which had been carried out by the staff. During the evening the Mayor and Deputy Mayoress of Barnsley attended.

Engineering Labour Agreement.—An evening paper says it is officially announced that three months' notice has been tendered on behalf of the Amalgamated Society of Engineers to the Engineering Employers' Federation "to terminate the national agreement for the settling of disputes and the premium bonus system. It is understood, however, that it is not the desire of the men that it shall be cancelled entirely, but that certain amendments shall be effected."

British Tramway Statistics.—The Board of Trade has just issued its tramway returns for the United Kingdom for the year 1912-13. The following figures show the progress made since the previous year's return:—

	1911-12.	1912-13.
Miles open	2,637	2,662
Miles run by cars ...	323,354,389	334,777,515
Passengers carried ...	3,127,318,732	3,219,857,293
Gross receipts	£14,726.068	£14,972,919
Working expenditure ...	£8,924,420	£9,384.798
Net receipts	£5,801.648	£5,588,121
Relief of rates	£488,509	£544,478
Aid from rates	£62,132	£64,988

The undertakings comprise 171 municipal and 115 company concerns. The net earnings of municipal tramways amounted to £4,095,957; £1,299,350 was applied to loan repayments, £544,478 in relief of rates, and £746,749 to reserve and renewals funds. The tramways of four local authorities and seven companies show an excess of working expenses over gross receipts. The lines open cover 2,662 miles, representing a capital expenditure of over 79 millions.

Striking Examples of Resuscitation.—Dr. Chas. A. Lauffer, medical director of the relief department of the Westinghouse Co., recently made some interesting statements regarding the resuscitation of victims of electric shock. Dr. Lauffer states that cases are on record where shocks received from 8,000 to 10,000-volt lines have not proved fatal, and where patients have been declared dead by physicians and yet have been resuscitated by the prone pressure method of resuscitation. He says that because the prone pressure has no apparatus to sell it gets very little advertising, and the general public has too little information of its value. Arc and static discharges from 240,000-volt conductors, and even higher voltages, are not necessarily fatal, if artificial respiration is resorted to at once, as shown by the following instances:—

CASE A.—During July, 1913, a patient received some 8,000 volts. He was unable to release himself from a live wire he had inadvertently touched, and which was fastened to a switchboard. He was badly burned in five places. The comrade nearest him, who saw him drop, knocked the line out of his hand. The duration of the dangerous contact exceeded 15 seconds. It required 15 minutes of rhythmic effort at artificial respiration to get him back to normal breathing. For a time he breathed as though every breath would be his last, his diaphragm being in tetanic contraction, but by increasing the elevation of the diaphragm at the rate of 12 times a minute, by the prone pressure method, this spasmodic type of respiration subsided, and normal breathing was restored.

CASE B.—The patient opened a live circuit and fell against a steel hose, receiving 10,000 volts, and the contact was of several seconds' duration. He lost two fingers and carries ugly scars on his palm, wrist and back. The honour of this rescue belongs to a man who has resuscitated six men without a failure. Why this man's uninterrupted success? He gets busy at once, for every second is an hour when the action of a man's diaphragm is paralysed. A victim of electric shock, and other conditions requiring resuscitation, needs instant assistance in the way of artificial respiration; few persons are killed outright by electricity.

CASE C. This man received 11,000 volts, yet was successfully resuscitated. His palms were so deeply burned that both hands were subsequently amputated.—*Canadian Electrical News.*

Human Cables.—From time to time remarkable "special" articles appear in the Daily Press, describing in glowing terms some new (alleged) discovery, such as "seeing by telegraph," "wireless telephony across the Atlantic," &c.; these sensational announcements are followed later by statements of fact which are put in much smaller type, if they are not suppressed altogether, and which usually knock the bottom out of the sensational specials. In the *Evening Standard* of January 14th such an article was printed, with regard to "a very important physiological discovery"—that "the human nervous system is composed of electrical cables, and that nerve impulses are electrical in their nature." The discovery is attributed to Dr. A. C. Crehore, of the Cornell Medical School, New York, who is said to have calculated the theoretical speed of electrical impulses along nerves, and found his calculation to agree with the actual speed (30 m. per second). He also found that the nerve resembled exactly an electrical cable, consisting of a bundle of fibres with an insulating sheath, and that it "had a capacity per unit length almost coinciding with the capacity per unit length of a cable"; whether electrostatic or current-carrying "capacity" is not stated, nor are we told what "cable" was used for the comparison, which resembles the well-known statement that a certain object was "about the size of a lump of chalk." Moreover, Dr. Crehore calculated the number of fibres there ought to be in the nerve to give the measured velocity, and again found his calculation in exact agreement with the number revealed by the microscope. Prodigious! But how does the velocity of an electrical impulse in a cable depend upon the number of strands in the cable? He constructed an artificial cable which behaved exactly like the nerve when tested with a strong (*sic*) galvanometer. Of course, a "string" galvanometer is meant; but when the reporter does not understand his subject, his imagination is brought into play.

Now, there may be something in the alleged discovery; there often is, in such cases, though it is usually something that has been known to the whole scientific world for months or even years. But before publishing an article of this kind, which reads to an electrician like nonsense, it would be well if the editor submitted the proofs to the inspection of someone competent to weed out technical blunders and absurdities. We may add that this particular subject has been studied ever since the celebrated experiment of Galvani in 1786, and many volumes have been written upon it.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Chesterfield T.C. has been recommended to increase the salary of MR. ACLAND, the borough electrical engineer, to £500 per annum, inclusive of rent, rates, fuel and light, the salary to be apportioned as under:—As electrical engineer, £350; as tramways manager, £150.

MR H. EDMONDS recently resigned his position with the Mersey Railway Co. to take up the post of resident engineer at the County Asylum, Chester. Upon leaving he was presented by the staff with a mahogany bookcase bureau, and by the company's Soirée and Athletic Club, of which he was vice-chairman, with a smoker's companion.

The Sheffield Corporation proposes to increase the salary of MR. FEDDEN, general manager of the electrical supply department, from £800 to £900, and by annual increments of £25, to £1,000 per annum.

MR. H. PARKER, second engineer in charge at the Dover Corporation electricity works, has resigned.

The chief assistant and other members of the engineers' staff at the Darlington Electricity Works are to receive special allowances in recognition of overtime worked during the preceding 12 months in connection with the extensions. Allowances are also to be given to three of the charge engineers in recognition of the additional work performed by them during the period between the resignation of one of the charge engineers and the appointment of his successor.

After a stout resistance by the "economists" of the Morley T.C. on Wednesday last week, the resolution increasing the salary of MR. J. E. ELLIS, the borough electrical engineer, from £225 to £250, was carried.

MR. DAVID TATTERSALL has resigned his position as engineer and secretary to the Ingleton Electric Lighting and Power Co., Ltd., and is taking up, immediately, the post of mains engineer with the Hindhead and District Electric Light Co., Ltd. MR. W. G. HURST, late chief assistant, Heckmondwike Electricity Supply Station, has been appointed to take up the post vacated by Mr. Tattersall.

MR. R. W. KLITZ has been appointed chief assistant electrical engineer at the Wimbledon electricity works, at a salary of £225 per annum.

MR. E. WOOLGAR, of Paisley, and MR. J. S. GIBSON, of Dewsbury, have been appointed engineers-in-charge at the Tunbridge Wells electricity works.

The Marylebone Electric Supply Committee have authorised the payment of a special bonus of £10 to MR. RATCLIFFE (generating station foreman) for working a very large amount of overtime, during practically the whole of the year, in consequence of the plant extension scheme.

The salary of MR. CORSON, as city electrical engineer and acting general manager of the light railways undertaking at Gloucester, is to be increased by £100 a year as from the date of his taking over the management of the light railways.

Tramway Officials. — The Manchester Corporation Tramways Committee has decided to recommend the Council to appoint MR. HENRY MATTINSON, now permanent-way engineer, chief civil engineer of the department, at the salary of £500 per annum, and to enter into an arrangement with him under which he is to agree to remain in the service of the Corporation for a period of four years from January 1st, 1914. Mr. Mattinson's salary is to be increased on January 1st, 1915, to £525; in 1916 to £550; and in 1917 to £600, which is to be the maximum salary for the position.

General.—We have received a picture postcard from the Maruzen Co., Ltd., of Tokio, Japan, with good wishes for 1914, which we heartily reciprocate.

The *Financial Times* states that MR. H. J. S. HEATHER, formerly of the "Corner House" staff, has been appointed Professor of Electrotechnics of the South African School of Mines.

MR. ROLAND DE VILLE, who has for nine years been a member of the staff of Messrs. Siemens Dynamo Works, Ltd., Stafford, and who is having to take up a position with Messrs. Wrigley, of Smethwick, has been presented by the office staff with a dressing case, and by the works employés with a suit case.

The *Globe* states that MR. W. T. SMITH, who has been connected with the Post Office Telegraph service for 44 years, will shortly retire from the position of traffic manager of telegraphs at St. Martin's-le-Grand.

Obituary.—The death occurred suddenly on Friday last of MR. E. A. LAZARUS BARLOW, who was a director of the Anglo-Argentine Tramways Co., Ltd., and was interested in a number of other well-known electrical companies, these including, according to the *Financial Times*, the British Thomson-Houston Co., Ltd., and the Chatham and Dublin Electric Tramway Companies.

The *Review of the River Plate* reports the death of MR. B. W. BAYLISS, superintendent of the United River Plate Telephone Co., which occurred on December 15th, of typhoid fever. Mr. Bayliss had only been in the country a few years. He was 35 years of age.

The death occurred on January 7th of MR. SAMUEL POTTS, who had held the position of electrician at the establishment of Messrs. Boots, Ltd., chemists, at Nottingham. He was only 32 years of age.

NEW COMPANIES REGISTERED.

Waygood Lifts (South Africa), Ltd. (133,322).—This company was registered on January 10th, with a capital of £10,000 in £1 shares, to take over the business carried on by R. Waygood & Co., Ltd., in South Africa, to carry on the business of manufacturers, constructors and suppliers of, and dealers in, lifts, elevators, cranes, hoists and lifting and hauling machinery, contractors, electricians, electrical, mechanical, hydraulic and general engineers, &c. The subscribers (with one share each) are:—H. Harmsworth, 65, Lewisham High Road, S.E., engineer; D. W. R. Green, 18, Tyson Road, Forest Hill, S.E., director. Private company. The number of directors is not to be less than two or more than seven; the first are Henry Claude Walker (chairman), H. Harmsworth, D. W. R. Green and Henry Cecil Walker. Registered by Bristows, Cooke & Carpmael, 1, Copthall Buildings, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

South African Lighting Association, Ltd.—Particulars of £10,000 debentures created May 27th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908: the amount of the present issue being £8,000 (renewals). Property charged: The company's undertaking and property, subject to first charge for £20,000. No trustees.

Electro-Flex Steel Co., Ltd.—Particulars of £30,000 7 per cent. debs., created December 19th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £15,000. Property charged: The company's undertaking and property, present and future, including uncalled capital, without power to create any mortgage or charge in priority to, or *pari passu* with, the debs. without the consent of the holders of two-thirds of the outstanding debs. No trustees.

Davis & Clark, Ltd.—A memorandum of satisfaction in full, on December 19th, 1913, of deb. dated September 2nd, 1911, securing £596 4s., has been filed.

Pernambuco Tramways and Power Co., Ltd.—Issue on December 18th, 1913, of £100,000 debs., part of a series of which particulars have already been filed.

United Electric Tramways of Monte Video, Ltd.—Issues from May 16th to October 31st, of £50,000 deb. stock, and from November 12th, 1913, to January 5th, 1914, of £16,019, deb. stock, parts of a series of which particulars have already been filed.

Foots Cray Electricity Supply Co., Ltd.—Issue on December 22nd, 1913, of £250 debs., part of a series of which particulars have already been filed.

British Prometheus Co., Ltd.—Issue on December 18th, 1913, of £300 debs., part of a series of which particulars have already been filed.

J. B. Saunders & Co., Ltd. (112,037).—Capital, £20,000 in £1 shares (6,000 "A" and 14,000 "B"). Return dated December 10th, 1913; 6,000 "A" and 12,000 "B" shares taken up; £18,000 considered as paid. Mortgages and charges: Nil.

Isle of Thanet Electric Tramways Co., Ltd. (49 978).—Capital, £300,000 in £5 shares (30,000 pref. and 30,000 ord.). Return dated December 18th, 1913; all shares taken up; £5 per share called up on the pref; £150,000 paid; £150,000 considered as paid on the ord. Mortgages and charges: £192,000.

Naylorgraph, Ltd.—Debenture, dated December 30th, 1913, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital (if any). Holder: J. M. Hunt, Fairlawn, Park Road, Southborough, Kent.

Larne Electric Light Works, Ltd. (46,962). — Capital, £4,000 in £1 shares (500 pref.). Return dated November 19th, 1913. 500 pref. and 3,500 ord. shares taken up. £500 paid on the pref. £3,500 considered as paid on the ord. Mortgages and charges: £2,700.

Lithanode, Ltd. (formerly Longstreth's, Ltd.) (64,823).—Capital, £3,000 in £1 shares. Return dated November 17th, 1913. 2,775 shares taken up. £2,340 paid (including £65 on 225 forfeited shares). £500 considered as paid on 500 shares. Mortgages and charges: £1,700.

Juga (Nigeria) Tin and Power Co., Ltd.—Debenture dated January 6th, 1914, to secure £4,000 charged on 60 tons of block tin at company's mine in Nigeria, or in course of transit to England. Holders: P. Bright, 641, Salisbury House, London Wall, E.C.; and H. Scipio Reitlinger, 60, London Wall, E.C.

CITY NOTES.

German Electrical Companies.

THE *Continental Telegraphen Compagnie, of Berlin*, after deducting general expenses and making provision for depreciation, reports net profits of £6,380 in the year ended with September 30th, 1913, as contrasted with £6,360 in the preceding 12 months. It is intended to distribute 12 per cent., being the same rate as in 1911-12, on share capital of £50,000.

The liquidators of the *E. H. Geist Elektrizitats Gesellschaft, of Cologne*, whose works were rented by the Colonia Electricity Co. on January 1st, 1912, report that the receipts in 1912-13 were solely derived from the rent paid. The final result for the year was a further loss of £1,000, which was defrayed out of the reserve fund, and the deficiency carried forward remains at £24,000. The option of purchase held by the Colonia Co., which is constantly well employed, still has a currency until the end of 1916.

The *Fabrik Isolierter Drahte zu Elektrischen Zwecken, of Berlin*, which reports an increased turnover in 1912-13, earned gross profits of £52,000, as compared with £50,000 in the previous year. After allocating £7,000 to depreciation as against £6,500, and allowing for other charges, the accounts exhibit net profits of £31,100, as contrasted with £30,600 in 1911-12. A dividend of 13 per cent. has been declared on share capital of £175,000, being the same rate as in 1911-12.

The Siemens Elektrische Betriebe A.G., of Berlin, which own electricity supply works, and are also interested in others as well as in tramways initiated by the Siemens group, record gross profits of £91,000 in 1912-13 on a share capital of £875,000 and loans of £1,053,000. The net profits, after meeting interest charges and general expenses, depreciation (£19,000), and allocation to renewal fund (£10,000), amount to £53,000, as contrasted with £35,000 in 1911-12. It is intended to pay a dividend of 6½ per cent., as in each of the three preceding years.

The Bergmann Elektrizitats Unternehmungen A.G., of Berlin, the subsidiary formed three or four years ago to finance the electrical enterprises of the Bergmann Electricity Works Co., earned gross profits of £6,800 in the third year which ended on June 30th, 1913. As this amount fails to meet the whole of the general expenses the year has closed with a loss of £4,000, thus increasing the debit balance to £36,000 on a paid-up share capital of £300,000. It was stated some time ago by the parent company that the scope of the subsidiary would be limited to the completion of transactions which were then in hand.

The Rheinische Schuckert Gesellschaft fur Elektrische Industrie, of Mannheim, which owns, or is otherwise financially interested in, a

number of supply works and tramways, states that the company's own undertakings experienced a normal development in 1912-13, and the business was further extended. The gross profits amounted to £128,000, as compared with £79,000 in 1911-12. After defraying general expenses, interest charges, and placing £38,000 to depreciation and reserve funds, as against £31,000, the accounts indicate net profits and balance forward of £56,000, as contrasted with £29,000. A dividend at the rate of 8 per cent. has been declared, as compared with 7½ per cent. on less capital in 1911-12.

Anglo-American Telegraph Co., Ltd.—The directors have declared the following dividends to the close of 1913, viz.:—A balance dividend of £1 10s. per cent. upon the ordinary consolidated stock for the year; a balance dividend of £1 10s. per cent. upon the preferred stock for the year; a first and final dividend of £1 10s. per cent. upon the deferred stock for the year; all payable on January 31st next, less income-tax. The above dividends, together with those already paid, will amount to £3 15s. per cent. on the ordinary consolidated stock, £6 per cent. on the preferred stock, and £1 10s. per cent. on the deferred stock for the year.

Japan.—Several more reports of Japanese electrical undertakings have just been issued. The Kyushu Electric Co. is paying a dividend of 11½ per cent. for the last half-year, an increase of ½ per cent. over the previous six months. The report of the Hakodate Water-Power Co. shows a net available profit of £11,808; of this sum £1,568 is being placed to reserve, £890 devoted to the directors and auditors, while £6,625 is being distributed to the shareholders in the form of a 10 per cent. dividend, leaving a small balance to be carried forward.

Dublin United Tramways, Ltd.—According to the *Financial Times*, the directors recommend a dividend at the rate of 5 per cent. per annum on the ordinary shares, making a distribution for the year at the rate of 5½ per cent., allowing £7,000 for renewals of rails and £5,000 for renewal of cars, leaving £9,957 to be carried forward. This represents a fall of ½ per cent. in the dividend for the year, and the appropriations to reserve and carry forward are also considerably down.

Consolidated Diesel Engine Manufacturers, Ltd.—The Shareholders' Committee's investigation of affairs having taken longer than anticipated, a circular has been issued deferring until the end of the month the meeting which was to have been held on Wednesday last. Definite recommendations respecting the future of the company will then be brought forward.

Direct United States Cable Co, Ltd.—An interim dividend of 2s. per share, less income-tax, being at the rate of 4 per cent. per annum, for the quarter ending December 31st, 1913, is payable on and after 31st inst.

Stock Exchange Notices.—The Committee has ordered the undermentioned to be quoted in the Official List:—

Bell Telephone Co. of Canada, Ltd.—Further issue of $6,250,000 5 per cent. bonds, 1925.

Electrical and Industrial Investment Co., Ltd.—£100,000 4½ per cent. debenture stock.

Canada.—According to the *Canadian Electrical News*, the Merchants Light, Heat and Power Co., of Quebec, have submitted to the local Legislature a by-law to amend their charter by increasing their capital from $800,000 to $3,000,000.

Kaministiquia Power Co—A dividend of 1½ per cent. for the quarter ending January 31st has been declared on the common shares.

France.—A new company has lately been formed in Paris (3, Rue Volney), with the title La Société Industrielle de l'Accumulateur Alcalin, and a capital of £24,000.

STOCKS AND SHARES.

Tuesday Evening.

THE promise of stronger markets which ushered in the new year has been fairly well maintained up to the present, and the Stock Exchange as a whole is doing a little more business than it was at the end of 1913. The serious trouble in South Africa in connection with the railway strike has had little effect upon markets, so slender is the public interest taken in South African mining matters at present. It is hoped there will be a further reduction in the Bank Rate before long, and the prospect of money becoming still cheaper suffices to buoy the price of Consols and of the many new issues which have recently flooded investment markets.

There is a better tone in English Electricity Supply shares. Several good-sized orders to buy the leading shares have come in during the past few days, and in one or two cases the orders could not be satisfied straight away, so small is the amount of floating supply at present. With the prospect of the electric light merger, shareholders in the best companies, of course, will not part with their shares for the time being, so that any extra demand has a pronounced effect upon the market, although it does not follow necessarily that quotations will be put up, for obvious reasons.

Shares in demand at present are St. James', Bromptons, Westminsters and Metropolitans. Citys are very quiet, and, with the return of Mr. Pierpont Morgan to the United States, possibly the market in them will remain quiescent for the time being. Soon the companies will be declaring the dividends for the second half of their year; and there is some little discussion going on as to whether there is likely to be any improvement in the distributions as compared with those of a year ago.

The Railway market has slipped back into a lethargic state, and had it not been for the Undergrounds, the movements for several days past would have proved very uninteresting. Metropolitans and Districts have been good, though the prices came back sharply, and show losses on the week. The Metropolitan Railway will declare its dividend on January 29th, and the District is expected to make its announcement about the same time or a little earlier. A year ago, the Metropolitan paid 1¾ per cent., making 1⅝ per cent. for the year, and it is expected to do rather better this time, though the dealers are chary of making any confident estimate. The London and Suburban issues are fairly well maintained, but in these, as in other domestic traction issues, business is meagre and public interest slack. Underground Electric Incomes have again advanced. London Electric Railway Debenture stock rose 2, and London United Tramways Debenture improved a point.

Mexico and Brazil continue to be severe thorns in the side of the Stock Exchange, and the securities of practically everything connected with those two countries are the reverse from steady. Mexican Light and Power Common shares fell to 36 and recovered to 40, but the Preferred dropped 6 and failed to rally, while the Second Mortgage bonds shed 4½ points on the top of their previous slump. Lively movements have been taking place in the price of Mexico Tramways. Down to 62 and up to 68 on the same day, they have since returned to the neighbourhood of 65, developing rather more steadiness at that level. General Huerta is supposed to have given an undertaking that private property shall be respected, this announcement referring more particularly to the tramway company, but it is pointed out that the best intentions of a commander in charge of a gang like the Mexican Army, may not admit of fulfilment, and the Mexican Railway Company has already suffered some slight damage. Monterey Debenture is 5 points lower at 52½; while Pachuca Debenture has suffered severely, too, falling back to 72½.

Montreal Light and Power shares are 3 points higher, but this section is dull as a whole, and there are falls in the bonds of the Electric Light Company of Cochabamba, and the Electric Development of Ontario. British Columbia Electric Railway stocks are flat, the report coming as a great disappointment to those who had looked for more expansion in the company's earnings. The Deferred stock fell 6, and the 4½ per cent. Vancouver Debenture lost 4 points at 98; a faint recovery occurred in the Deferred, leaving it at 101.

Brazil issues, of whatever kind, are mostly under a cloud; and depression has seized upon prices in the markets for the Government bonds, municipalities, and utility companies. Brazilian Tractions, however, show no loss on balance. Small falls have occurred in Rio Janeiro Tramway bonds and Sao Paulo Debenture stock. Para Electric Ordinary shares have lost another 10s., and the Preference have failed to recover from their heavy fall. On the other hand, the Argentine group is better. Anglo-Argentine Trams First Preference improved to 4⅞. Southern Electric of Buenos Ayres Debenture stock hardened to 96, a rise of 2. Cape Electric Trams are unaffected by the South African troubles, as are also Victoria Falls Power Preference shares. Brisbane Preference improved a trifle, and Auckland Debenture rose a point.

In the Telegraph market, Anglo-American Preferred and Deferred stocks are a little lower, apparently on the vague idea that the Company's arrangement with the Western Union will have to be modified, in view of the way in which various American trusts are splitting up into their component parts. The Eastern group is firm, and there are rises, too, in Globe Ordinary, Great Northern and West India and Panama shares. The last-named spurted $\frac{5}{16}$ upon buying that was supposed to owe its inspiration to America. Marconis have lost their ⅛ rise of last week. Oriental Telephones at 1$\frac{15}{16}$ are $\frac{1}{16}$ harder, and New York Telephone bonds further improved upon their rise of last week.

The Manufacturing group is steady, with the exception of Castner Kellners, which fell ¼ upon realisations by those who were waiting for the deduction of the dividend and bonus before they sold. British Insulated shares followed up their rise of 7s. 6d. by a similar improvement, which carried the price to 8¾. Willans and Robinson Preference gained 3 points. Babcocks are a shade better, undisturbed by the discussions current as to the advisability of reducing naval expenditure. The Rubber share market, after being firm, gave way a trifle upon a shaving-off of ¼d. from the price of the raw stuff, which brought about dulness in the leading shares and checked the little demand to cheer the market which was inaugurated at the New Year. Later, however, more resiliency was displayed, and many of the leading shares improved by reason of the Mincing Lane sales on Tuesday realising better prices than had been expected.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Jan. 13th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	⅜ — ½	..	Nil
Do. 5 % Pref.	1	5	5	3⅝ — 3¾	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	12 — 14	+ ½	..
Do. Do. Deferred	100	..	..	4½ — 6	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	87 — 90	..	6 13 4
Do. 7 % Non-Cum. Pr'f.	100	8	..	52 — 55	..	5 9 1
Do. 5 % Perp. Deb.	100	5	5	92 — 95	..	5 5 5
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 80	..	5 12 6
Central London Railway, Ord.	100	8	3	59 — 64	—2	4 13 9
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Def.	100	2	..	60 — 65	..	3 1 7
Do. Gtd. Assented	100	..	4	78 — 80	..	5 0 0
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	96 — 98	..	5 2 0
Do. Do. 1896	100	5	5	96 — 98	..	5 2 0
Do. Do. 1901	100	5	5	95 — 97	..	5 3 1
Do. Do. 1903	100	5	5	93 — 95	—1	5 5 0
Do. 4 % Deb.	100	4	4	89 — 91	..	4 8 0
Hastings Trams, 6 % Pref.	1	6	6†	⅛ — ¼	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2¼	+ ⅛	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76 xd	..	5 5 3
Lancashire United, 5 % Deb.	100	5	5	77 — 81	+2	6 3 5
London and Suburban, Ord.	1	..	..	⅛ — ¼	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	3/16 — 5/16	..	6 18 9
Do. Do. 4½ % 1st Deb.	100	4½	4½	72 — 77 xd	..	5 17 0
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	+2	4 7 0
London United Trams, 4 % Deb.	100	4	4	58 — 62	+1	6 9 2
Metropolitan Railway Consol.	100	1⅝	1¼†	45¼ — 45½	—1/4	3 11 0
Do. Surplus Lands	100	2½	2¾†	58 — 60	..	4 11 8
Do. 3½ % Deb.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	78 — 80	..	4 7 6
Do. 3½ % Con. Pref.	100	3½	3½	76 — 78	+1	4 9 9
Metropolitan District Ord.	100	Nil	..	31 — 31⅛	— ⅛	Nil
Do. 6 % Deb.	100	6	6	133 — 136 xd	..	4 8 8
Do. 4 % Deb.	100	4	4	90 — 92 xd	..	4 7 0
Do. 4 % Prior Lien	100	4	4	94 — 96	..	4 3 4
Do. 4½ % First Pref.	100	4½	4½	81 — 83	..	5 8 5
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	80 — 84 xd	..	5 7 2
Do. 5 % Deb.	100	5	5	86 — 89	..	5 12 0
Potteries, Ord.	1	3¼	..	7/16 — 7/32	..	..
Do. 5 % Pref.	1	5	5	7/16 — 1/2	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	⅜ — ½	..	8 0 0
Do. 4 % Deb.	100	4	4	66 — 70 xd	..	5 14 4
Underground Elec. Railways	10	..	..	3½ — 3¾	..	Nil
Do. "A"	1/-	..	..	3/32 — 5/32	+ 1/32	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	112 — 114	..	5 5 2
Do. 4½ % Bonds	100	4½	4½	98 — 100 xd	—1	4 10 0
Do. 6 % Income	100	6	6	91½ — 92½	+1½	6 9 9
Yorkshire (West Riding), Ord.	5	Nil	..	⅛ — ¼	..	Nil
Do. 6 % Pref.	5	3	4	3¾ — 4	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	79 — 84	..	5 7 2

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5⅜	5⅜	4⅜ — 5	+ 1/16	5 10 0
Do. 2nd Pref.	5	5⅜	5⅜	4 3/16 — 4 7/16 xd	..	6 3 11
Do. 4 % Deb.	100	4	4	89 — 91	+1	4 8 0
Do. 4½ % Deb.	100	4½	4½	96 — 98 xd	..	4 11 10
Do. 5 % Deb.	100	5	5	97⅞ — 99½	..	5 0 6
Auckland Trams, 5 % Deb.	100	5	5	100 —103 xd	+ ½	4 17 0
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11⅞	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	92 — 94 xd	..	4 15 9
Do. 5 % 2nd Deb.	100	5	5	95 — 98 xd	..	5 2 0
Brazilian Traction, Light and Power	$100	6	6†	88 — 85	..	7 1 2
Brisbane Trams Invt., Ord.	5	8	8	7⅞ — 7⅞	..	5 3 8
Do. 5 % Pref.	5	5	5	4⅝ — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	96 — 99 xd	..	4 11 0
B. Columbia Elec. Rly., Def.	100	8	8†	99 —103	—5	7 15 4
Do. Pref. Ord.	100	6	6	99 —103	—3	5 16 6
Do. 5 % Pref.	100	5	5	99 —103	—2½	4 17 0
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101	..	4 9 1
Do. 4½ % Vancouver Deb.	100	4½	4½	96 —100	—4	4 10 0
Do. 4½ % Con. Deb.	100	4½	4½	91 — 94	—1	4 10 0
Calcutta Trams, Ord.	5	7½	5†	6 — 6½	..	5 15 5
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛ xd	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	95 — 98	+2	4 11 10
Cape Electric Trams	1	5	5	⅞ — 1	..	6 19 0
City Buenos Aires Trams (1904)	5	5†	5	5⅛ — 5⅜	..	4 10 11
Do. 4 % Deb.	100	4	4	91 — 96 xd	..	4 3 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — 1/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	10 — 20	..	Nil
La Plata Elec. Trams, Ord.	1	..	..	⅜ — ½	..	..
Do. Pref.	1	4⅜d.	6	¾ — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1⅛ — 1⅜	..	4 7 8
Do. 6 % Pref.	1	6	6	1 1/16 — 1 3/16 xd	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	4¼ — 5¼	..	5 14 3
" Elec. Tr. (1904), Deb.	100	5	5	99 —101 xd	..	4 19 0
Manaos Trams & Lt., 1st Deb.	100	5	5	79 — 82 xd	..	6 2 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	96½ — 98½	..	5 1 6
Mexico Trams Com	$100	7	7	63 — 66	..	10 15 4
Do. Gen. Con. 5 % Bonds	..	5	5	74 — 79	—1½	6 6 7
Do. 6 % Bonds	100	6	6	74 — 76	—2	7 18 0
Para Elec. Rlys. & Lt., Ord.	5	10	10†	5 — 5½	— ½	9 1 10
Do. 6 % Pref.	5	6	6	4½ — 4⅝	..	6 9 9
Do. 5 % 1st Deb.	100	5	5	93½ — 95½	..	5 4 6
Perth (W.A.) Elec. Tr., Ord.,	1	5½	..	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½ xd	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	94½ — 96½ xd	..	4 13 3
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	97 — 99 xd	— ½	4 19 0
Do. 5 % Mort. Bonds	100	5	5	89 — 91	—1	5 10 0
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	96 — 99	—1	5 1 0
Singapore Trams, 5 % Deb.	100	5	5	86 — 90	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 97	+2	5 3 1
Un. Elec. Trams Monte Video	5	7	7	4⅜ — 4⅝	..	7 3 7
Do. 6 % Pref.	5	6	6	5⅛ — 5⅜	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	93½ — 96½	..	5 8 8
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

	*	1912.	1913.			£ s. d.
Bournemouth & Poole, Ord.	10	6	5†	9 — 10	..	4 14 9
Do. 4½ % Pref.	10	4½	4½	8½ — 9½	..	6 0 0
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	93 — 96 xd	..	4 13 9
Brompton & Kensington, Ord.	5	10	9†	8¾ — 9¼	+ ⅛	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8½ — 8¾	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	90 — 93	..	4 6 0
Charing Cross, West End & City	5	5	5†	4½ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3½ — 4 xd	..	5 12 6
Do. Do. 4 % Deb.	100	4	4	90 — 92	..	4 8 0
Chelsea, Ord.	5	5	4†	4⅝ — 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	95 — 98	+1	4 11 9
City of London, Ord.	10	9	6†	16½ — 17½	..	5 2 10
Do. 6 % Cum. Pref.	10	6	6	13 — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	114 - 118 xd	..	4 4 9
Do. 4½ % Second Deb.	100	4½	4½	97½ — 99½ xd	..	4 10 6
County of London, Ord.	10	6	5†	11⅝ — 12½	..	4 18 0
Do. 6 % Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	101 —103 xd	..	4 7 5
Do. 4½ % Second Deb.	Stock	4½	4½	98 — 101	..	4 9 1
Edmundson's, Ord.	£3	..	..	1/16 — 1/8	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3⅞ — 4⅛	— ⅛	7 5 5
Do. 6 % Non-Cum. Pref.	5	..	..	1¼ — 1⅝	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	81 — 84	+1	5 7 2
Folkestone	5	6	6	4⅜ — 4⅝	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4⅝	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	89 — 91	..	4 19 0
Hove	5	8	8†	8¾ — 9¼	..	4 17 3
Kensington & Knightsbridge, Ord.	5	8	8†	7¾ — 8¼	..	4 17 0
Do 4 % Deb.	Stock	4	4	90 — 93	..	4 7 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	76 — 80	..	5 12 6
London Electric, Ord.	3	2½	..	1⅛ — 1⅜	..	4 12 7
Do. 6 % Pref.	5	6	6	4⅝ — 5¼	..	5 14 3
Do. 4 % First Mort. Deb.	Stock	4	4	90 — 93	..	4 6 3
Metropolitan	5	4	4†	3⅜ — 3⅝	+ ⅛	5 3 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	96 — 99	+1	4 10 10
Do. 3½ % Mort Deb.	Stock	3½	3½	79 — 82 xd	+1	4 5 5
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 — 103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9⅞ — 10½ xd	..	5 14 3
Oxford	5	7	6†	6 — 6⅜	..	5 7 8
St. James' and Pall Mall, Ord.	5	10	10†	8½ — 9	..	5 11 1
Do. 7 % Pref	5	7	7	6⅝ — 7⅛	..	4 18 3
Do. 3½ % Deb.	100	3½	3½	82 — 85	+1	4 2 4
South London, Ord.	4	5⅓	..	2⅜ — 2½	..	6 15 4
Do. 5 % First Mort. Deb.	100	5	5	97 — 100	+1	5 0 0
South Metropolitan, 7 % Pref.	1	7	7	1⅜ — 1⅝	..	5 14 9
Do. 4½ % First Deb. Stock	100	4½	4½	93 — 96	..	4 13 9
Urban, Ord.	£3	Nil	..	1/16 — 3/32	..	..
Do. 5 % Cum Pref.	5	3½	..	2⅛ — 2⅜	..	5 4 4
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Westminster, Ord.	5	10	10†	8½ — 9	+ ¼	5 11 1
Do. 4½ % Cum Pref.	5	4½	4½	4 13/16 — 5 3/16	..	4 6 10

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ 8s. Cash and 2% in Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 13th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	£	6	6†	5¼ — 5⅝	..	£ s. d. 5 11 7
Calcutta, Ord.	£	8½	5†	8⅜ — 8⅝	+ ¼	5 8 0
Do. 5 % Pref.	£	5	5	4¾ — 5⅛	..	4 17 7
Calgary Power, 1st Mort. Bds.	100	5	5	88½ — 90½ xd	..	5 9 3
Canadian Gen. El. Com.	$100	7	8	102 —107	..	7 9 7
Do. 7 % Pref.	$100	7	7	119 —124	..	5 12 11
Cordoba Lt., Power and T., Ord.	1	5	..	⅞ — ⅝	..	7 13 0
Do. 5 % Deb.	100	5	5	91 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	88 — 90	— ½	6 13 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94 xd	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93½ — 95½	—1	5 4 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅜ — ½	..	Nil
Do. 6 % Pref.	£	6	6†	⅝ — ¾	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	100½—102½ xd	..	4 17 6
Madras, Ord.	£	Nil	..	1½ — 1¾	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	101 —104 xd	..	4 16 0
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	63 — 66	..	7 11 6
Mexican Lt. & Power, Common	$100	4	4	38 — 43	+3	9 6 0
Do. 7 % Cum. Pref.	$100	7	7	68 — 73	—6	9 11 10
Do. 5 % 1st Mort. Gold Bds.	..	5	5	73 — 77	—2½	6 9 10
Do. 5 % 2nd Mort. Bonds	100	5	5	58 — 62	—4½	8 1 4
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	* 100	1913. 5	1913. 5	50 — 55	—5	£ s. d. 9 1 10
Montreal, Lt., H. and Power	$100	9	10†	219 —225	+ 3	4 9 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	..	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	101 —106	..	5 18 2
Do. 5 % Deb. Stock	Do.	5	5	93 —100 xd	..	5 0 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 4
Shawinigan Water, Capital	$100	5½	6†	134 —138	..	4 7 0
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	103½—105½ xd	..	4 14 9
Do. 4½ % Per. Deb.	Stock	4½	4½	96 — 98	— ½	4 11 10
Toronto Power, 4½ % Deb.	Do.	4½	4½	95 — 98	..	4 11 10
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	87 — 89 xd	..	5 12 4
Victoria Falls Power, Pref.	1	6	6	⅞ — ⅞	..	7 2 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	108 —105	..	5 14 3

MANUFACTURING COMPANIES.

Aron, Ord.	£	7	..	⅞ — 1⅛	..	8 12 4
Do. 6 % Pref.	£	6	6	7⅞ — 8 xd	..	8 0 0
Babcock & Wilcox	£	16	14†	21⅜ — 3⅛	+1⅛	5 4 6
Do. Pref.	£	6	6	1⅛ — 1⅜	..	4 8 6
British Aluminium, Ord.	£	..	..	1 — 1⅛	..	..
Do. 6 % Cum. Pref.	£	6	6	⅞ — ⅞	..	6 12 6
Do. 5 % Prior Liens Debs.	100	5	5	92 — 95 xd	..	5 5 0
Do. Deb. Stk.	100	5	5	85 — 87	..	5 15 0
B.I. & Helsby Cables	£	10	8†	8½ — 9	+ ⅛	5 11 1
Do. Pref.	£	6	6	5⅞ — 6⅛	..	4 16 0
Do. Deb.	100	4½	4½	99 —102	..	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 14 9
British Westinghouse, Pref.	£	Nil	..	1⅛ — 1⅜	..	Nil
Do. Deb.	100	4	4	64 — 67 xd	..	5 19 5
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	£	..	..	2/- —3/-	..	Nil
Do. Pref.	£	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	£	2	Nil	⅛ — ⅜	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	75 — 80 xd	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	36 — 41	+ ½	10 19 6
Do. 4½ % Second Deb.	100	4½	4½	23 — 27 xd	..	16 13 4
Callender's Cable	£	15	5†	10½ — 11½	..	6 13 4
Do. Pref.	£	5	5	4⅛ — 5⅛ xd	..	4 18 9
Do. Deb.	100	4½	4½	95 — 98 xd	..	4 8 6
Castner-Kellner	£	20	22½	21⅞ — 22½	— ⅛	..
Do. Deb.	100	4½	4½	104 —107	..	4 4 1
Crompton & Co., Deb.	100	5	5	66 — 71 xd	..	7 0 10
Dick, Kerr	£	Nil	..	⅛ — ⅜	..	..
Do. Pref.	£	6	6	⅝ — ¾	..	7 2 2
Edison & Swan, A, £2 paid	£	Nil	..	0 — ⅛	..	Nil
Do. fully paid	£	Nil	..	1 — 1⅛	..	Nil
Do. 4 % Deb.	100	4	4	55 — 59 xd	..	6 15 7
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Electric Construction	£	1	5	⅛ — ⅜	..	7 5 6
Do. Pref.	£	1	7	1⅛ — 1⅜	..	6 11 9
Greenwood & Batley, Pref.	£	10	7	6¾ — 7¼	..	9 13 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	£	10	6	9⅝ — 10⅛ xd	..	5 18 5
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	£	15	10†	12⅝ — 13½	..	5 11 1
Do. Pref.	£	5	4½	4⅝ — 5	..	4 10 0
Do. Deb.	100	4½	4½	99 —101	..	4 9 0
India-Rubber, G. & T.	£	10	7½	11 — 12 xd	..	6 5 0
Do. Pref.	£	10	5	9 — 9½ xd	..	5 2 7
Telegraph Construction	£	12	20	37 — 39	..	6 3 1
Do. Deb.	100	4	4	96 — 98 xd	..	4 1 8
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	65 — 69	..	5 16 0
Do. B 4 % Cum. Pref.	100	..	..	51 — 56	+3	..

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	£	10	4½	4½	6½ — 6⅞	..	6 18 4
Do. 5 % Deb. Red.	Stock	5	5	98 — 96	+ ½	5 4 0
American Telep. & Teleg., Cap.	$100	8	8	124 - 127 xd	..	6 6 0
Do. Collat. Trust	$1000	4	4	87 - 90 xd	..	4 9 0
Anglo-American Telegraph	Stock	3	3	63 — 66	..	4 11 0
Do. 6 % Pref.	Do.	6	6	105 —106	— ½	5 13 2
Do Def.	Do.	30/-	..	24¼ — 24⅝	— ⅛	6 1 3
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	£	8	..	7⅞ — 7⅞	..	5 5 10
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	77⅛ — 79⅛	— ½	5 0 6
Cuba Telegraph	£	10	6	8 — 9	..	6 13 4
Do. 10 % Pref.	£	10	10	14½ — 15½	..	6 9 0
Direct Spanish Telegraph, Ord.	£	5	4	8½ — 8¾	..	5 6 8
Do. 10 % Cum. Pref.	£	5	10	6¾ — 7¼	..	6 18 0
Direct United States Cable	£	10	4	4†	6¼ — 6⅝	..	5 18 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	96 —98 xd	..	4 11 10
Eastern Telegraph, Ord. Stock	Stock	7	7	125 —128	+1	5 9 8
Do. 3½ % Pref. Stock	Do.	3½	3½	7⅛ — 7⅞	+ ⅛	4 10 4
Do. 4 % Mort. Deb.	Do.	4	4	94 — 96	..	4 8 4
Eastern Extension	£	10	7	7	12 — 12½	..	5 12 0
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Globe Telegraph and Trust	£	10	6	6†	10⅞ — 11¼	+ ⅛	5 6 8
Do. 6 % Pref.	£	10	6	6	11⅞ — 12¼	..	4 18 0
Great Northern Telegraph	£	10	20	5†	31 — 33	+ ½	6 1 2
Indo-European Telegraph	£	25	13	5†	57 — 59	..	5 10 2
Mackay Companies Common	$100	5	5	77 — 81	—2	6 3 5
Do. 4 % Cum. Pref.	$100	4	4	66 — 70	+2	5 14 4
Marconi's Wireless Telegraph	£	1	20	20	3½ — 3⅝	— ⅛	5 18 8
Do. 7 % Cum. Partic. Pref.	£	1	17	..	2⅛ — 2⅛	—⅛	6 0 9
Monte Video Telephone, Ord.	£	1	6	6	⅞ — 1	..	6 0 0
Do. 5 % Pref.	£	1	5	5	⅞ — 1	—⅛	6 18 4
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	98½ — 99½	+ ½	4 10 8
Oriental Telep. and Elec.	£	1	10	10†	1⅝ — 2	+ ⅛	5 0 0
Do. 6 % Cum. Pref.	£	1	6	6	1⅞ — 1⅞	..	5 1 1
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	+1	4 11 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96 — 98	..	4 1 8
Reuter's	£	10	10	10†	8⅜ — 9⅝	..	10 5 2
Submarine Cables Trust	Cert.	6	6	122½ —125½	..	4 15 7
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	+1	4 12 9
United River Plate Telephone	£	5	8	6†	6⅜ — 6⅞	..	5 16 5
Do. 5 % Cum. Pref.	£	5	5	5	4⅛ — 4⅜ xd	..	4 13 0
West Coast of America	£	2½	2½	..	1⅞ — 1⅞	..	4 3 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	94 — 97	..	4 2 6
West India and Panama Teleg.	£	1½	1½	2⅜ — 2⅝	+⅛	5 0 0
Do. 6 % Cum. 1st Pref.	£	10	6	6	9½ — 10½	..	5 17 0
Do. 6 % Cum. 2nd Pref.	£	10	6	6	9 — 9¾	..	6 6 4
Do. 5 % Debs.	100	5	5	96 — 98 xd	..	5 2 0
Western Telegraph, Ltd.	£	10	7†	7	12⅜ — 13½ xd	..	5 6 8
Do. 4 % Debs.	Stock	4	4	90 — 92 xd	..	4 7 0
Western Union 4½ % Fdg. Bonds	$10.0	4½	4½	92 — 96	..	4 14 9

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants.

Bank rate of Discount 4½ per cent., January 8th, 1914.

Spark Frequency and Wave Length.—In the course of a recent communication, Count Arco commented on the great increase in spark frequency and wave length employed during recent years in wireless telegraphy. Between 1890 and 1899, the usual spark frequency was from 10 to 20 per second, and the usual wave length from 100 to 300 m. During the next eight years, the frequency increased from 20 to 100 per second, and the wave length to from 300 to 1,500 m. Then, between 1907 and 1912, the spark frequency rose rapidly to 1,000 or 2,000 per second, and the wave length employed increased to between 1,500 and 10,000 m. At the present day, the frequency typical of the largest land stations is 500 per second, and the wave length 15,000 m. (9·3 miles). These remarkable increases in spark frequency and wave length are attributable to the invention of the singing quenched spark, and, on the other hand, the comparatively low oscillation frequency now employed by the largest stations is necessitated by the very great wave length adopted. The generation of long waves, *i.e.*, the generation of comparatively low-frequency oscillations, is a simple matter, but it is difficult to radiate such waves efficiently. The 6,000-m. wave length employed between the Marconi stations at Glace Bay and Clifden (3,200 km. apart) is not sufficient for satisfactory radio-telegraphy over the 6,000 km. which separate Nauen from Sayville (Long Island). Using a 6,000-m. wave over this route, day signals are much more feeble than night signals, hence a 10,000-m. wave is employed. The radiation of such waves requires a tower 500 m. in height if the umbrella type of aerial be adopted, so that there is considerable advantage in employing lofty horizontal aerials.

BRITISH INTERESTS IN CHINA.

Progress of the Hong-Kong University.

By Prof. C. A. M. SMITH, M.Sc.

After one year's work it is possible to estimate, in some measure, the probable effects and the general progress of the only British University in the Far East. On October 15th, 1912—just a year ago—the first tangible efforts for influencing British trade in China by technical education began in the Orient. On that date the University of Hong-Kong commenced its career with all the auspices of success. There were 55 first-year Undergraduates, of which number 37 elected to take the Engineering course. There are now in the three Faculties of Medicine, Engineering and Arts 110 Undergraduates, and more than half the number have elected to take up studies in the Engineering Faculty.

Valuable Presentations.—It must be stated at the outset that the chief reason for the success of the Applied Science section of the University has been the magnificent response made by British engineering firms to the appeal for equipment (issued less than a year ago). The Chinese have many opportunities to go to Japan, Europe and America for their technical education, and it was realised in the earliest stages of the development of this British University, that unless the students were offered instruction and equipment equivalent to that obtainable in the "West," they would not attend. Fortunately, everyone in China now realises that the little colony of Hong-Kong has again been true to the traditions which have led to its remarkable development. It has done thoroughly what it promised should be done.

But the promises have only been redeemed through the promptitude of the British manufacturers and shipping companies to grasp this unique opportunity for furthering British trade interests. The practical result is that the newest British university is assured of engineering equipment valued at £12,000. Moreover, the plant is essentially modern, and has been selected solely for experimental and educational purposes.

Undoubtedly the influential support given by the Electrical Review in its leading article of November, 1912, brought the matter to the notice of large firms, many of whom at once wrote to the university mentioning this fact. The *Engineer* and *Eastern Engineering* also generously supported the appeal. The first firm whose offer was received in Hong-Kong was the Chloride Electrical Storage Co., and on November 15th, 1912, we received the cable: "Supplying battery Chloride." Another cable, which will always be remembered in Hong-Kong, was from the Campbell Gas Engine Co., and this was: "Sending gas engine with producer and vertical two-cycle marine oil engine Camgas." There were other splendid offers, especially those of Messrs. Crossley, Babcock & Wilcox, Samuel White and the General Electric Co., Ltd.

However, after four months, it was found that less than half the equipment required had been presented. We were stirred up into taking some action with regard to machine tools by the attempt made in Hong-Kong to build a technical school and workshop equipped with American tools. Therefore the writer proceeded to England during the recent long vacation, reaching London on June 4th, and leaving on August 16th.

During the visit more than 200 manufacturers and a number of public men were interviewed on behalf of the University, and while most of the work was done in London, visits were also made to Glasgow, Birmingham, the Midlands and Cambridge (at the latter place there was a four days' meeting of the Institution of Mechanical Engineers).

In Glasgow a meeting of the British Engineers' Association was held in June, and the writer was allowed to address the same on behalf of the University. He had interviews with many individual members, and addressed the following Committees:—(1) British Engineers' Association; (2) China Association; (3) Manchester Chamber of Commerce; (4) Walsall Chamber of Commerce; (5) British Electrical and Allied Manufacturers' Association. All of these meetings had the effect of producing interest in the work of the University and tangible results. The two outstanding features of the visit were the sympathetic reception accorded to the writer by manufacturers, and the magnificent offer of the British Electrical and Allied Manufacturers' Association to equip the electrical laboratories. Lord Ampthill, the president, Mr. Bruce Anderson, the chairman, Mr. Hugo Hirst, and other influential members of the Association, took a deep and personal interest in the matter. The result was worthy of the British electrical industry.

The Result of the Visit.—It was found that the people who were willing to give tangible support to the University were the manufacturers, and the arguments which appealed to them were:—(1) The humanitarian results to be expected from the introduction of pure and applied science into a land where famine and flood are so frequent; (2) that Hong-Kong is a British Colony; (3) that the University will assist in maintaining British prestige in the Far East; (4) that trade results will follow technical education.

The Eastern Extension Telegraph Co. considered the suggestions that they should subscribe to the funds of the University, and have made a donation of £500. A large number of the manufacturers interviewed offered valuable equipment, and it is believed that further assistance will be obtained. Some makers of scientific apparatus were seen. Messrs. Philip Harris & Co., Ltd., Birmingham, are sending out selected physical apparatus, and Messrs. Pye, Cambridge, mechanics apparatus; Messrs. Negretti & Zambra will present a complete meteorological outfit, and it should be possible to record daily observations of the weather, &c., at the University. The Silent Electric Clock Co., Ltd., presented half-a-dozen clocks, and a master clock, for the electrical control system.

The original plans of the University provided for a workshop and a small experimental laboratory. The present plans provide for: (1) A gas and oil engine laboratory which will also be the electrical generating station; (2) An electrical machinery laboratory; (3) An applied mathematics and mechanics laboratory; (4) A fuel and cement testing laboratory; (5) Strength of materials laboratory; (6) An electrical technology laboratory; (7) An engineers' workshop; (8) A carpenters' shop; (9) A steam engine laboratory; and (10) A hydraulic laboratory. It may be of advantage to mention some of the more important items of the equipment of these laboratories. In the electrical generating station there are two gas engines and producers presented respectively by the Campbell Gas Engine Co., of Halifax (35 B.H.P.), and Messrs. Crossleys, Ltd., Manchester (15 B.H.P.). The Campbell engine drives a dynamo presented by the General Electric Co., Ltd., London; and the Crossley engine drives a dynamo presented by the Lancashire Dynamo Co., Ltd., Manchester. Amongst the other engines in this laboratory is the Gardner oil engine driving an 8-KW. dynamo; Messrs. Gardner presented the whole set. Messrs. Daimler have promised a 25-B.H.P. silent Knight engine, and the Westinghouse Brake Co. one of their Cross crude oil engines. The Griffin Engineering Co. have presented a patent brake. Messrs. E. R. & F. Turner, of Ipswich, presented an oil engine, and a dynamo for the set has been promised. Messrs. Ferranti, Ltd., Manchester, will supply the switchboard for this laboratory. This firm will also supply the resistances, &c., needed.

In the electrical machinery laboratory there will be about 30 motors and dynamos of different varieties. Messrs. Mather & Platt, Ltd., Manchester, have promised boosters, motors, &c., and Messrs. Vickers, Ltd., various dynamos and motors; the switchboard will probably be supplied by the General Electric Co., Ltd.; the British Thomson-Houston Co., Ltd., will supply a rotary converter and various motors; Messrs. Bruce Peebles, Ltd., Edinburgh, will supply an A.C. motor; and the Electrical Construction Co., Ltd., of Wolverhampton, D.C. dynamo and motors. Messrs. Elliott Bros., Ltd., will supply various measuring instruments, and other firms have made promises to the writer, but are referring details to a special Committee of the British Electrical and Allied Manufacturers' Association to prevent over-lapping. Messrs. Callender and Messrs. Henley are supplying all the cables; and Messrs. Miller, Edinburgh, the cast-iron slide rails.

In the Strength of Materials Laboratory there will be a

30-ton tensile testing machine, presented by Messrs. Buckton, of Leeds; this will be electrically controlled by a special motor, built by Messrs. Vickers, Ltd. Arrangements have been made for microphotography.

In the engineers' workshop there will be a 6-in. lathe, presented by Messrs. Lang, of Glasgow; a special reversible planer, with electrical control, presented by Messrs. Craven, Ltd., and the Lancashire Dynamo Motor Co., Ltd., both of Manchester; a shaping machine, by Messrs. Hulse, Manchester; and a radial drill, by Messrs. Archdale, Birmingham. Also a lathe, by Messrs. Buck and Hickman, Ltd.; a sensitive drill by Messrs. Smith and Coventry; and a hacksaw, by Messrs. Herbert, Ltd., Manchester. Messrs. H. W. Ward, Birmingham, will send either a capstan lathe or a milling machine.

A mechanical power hammer was promised by Messrs. Judson-Jackson Co., Ltd., and shafting and pulleys by Messrs. Samuel Platt, Ltd.; Messrs. Brown, Ward, Ltd., will send a light drilling machine, and Messrs. Jones and Shipman, Ltd., a 20-in. high-speed drilling machine. The Selson Engineering Co., Ltd., have promised a 5½-in. lathe, and Messrs. Drummond a 3½-in. lathe, with electric motor complete; Messrs. B. & S. Massey, Ltd., will send a 1-cwt. pneumatic hammer, and Messrs. Reavell, one of their latest types of air compressors. Messrs. Rowland & Co., Ltd., have presented a combined tool and dry grinding machine electrically-driven. A universal grinder and tool grinder have been given by Messrs. Luke & Spencer, Ltd. A number of firms are sending workshop accessories, such as gauges, small tools, &c.

In the carpenters' shop there are wood-working machines presented by Messrs. Thomas Robinson & Son, Ltd., and Messrs. A. Ransome & Co., Ltd. It is impossible to give details of the electrical technology laboratory, but offers are continually arriving, and all of the apparatus will be presented by the chief electrical firms in Great Britain, many of whom very kindly received the writer at their various works. In the hydraulic laboratory there will be the Ruston Proctor oil engine and pump, the Hayward-Tyler hot-air engine and pump, a Venturi meter, centrifugal and other pumps, meters, &c.

Several firms promised presentations of surveying instruments. Messrs. Stanley Bros., Ltd., are sending theodolites, levels, &c., and Messrs. T. Cooke & Sons, Westminster, Messrs. Norton & Gregory, Messrs. Hall and other makers will also send out surveying instruments.

Interviews were obtained with officials of the Colonial Office, the Foreign Office, the Treasury and the Board of Trade. Others who especially assisted were Mr. Douglas Vickers, Sir Frederick Lugard, Mr. Hugo Hirst, Mr. Bruce Anderson, Dr. Hele-Shaw, and Mr. Stafford Ransome.

Future Developments.—When the scheme of the British University of Hong-Kong was first mooted, the patriotic Viceroy of Canton sent a dispatch to the chief officials of the various Government Bureaus under his jurisdiction. He used these words: "The teaching of applied science, including civil, mechanical and electrical engineering and surveying, meets the present and most urgent needs of our country." During the last 18 months, the writer has travelled nearly 35,000 miles—across Canada, through Arizona and California, in Japan, in China, Korea, the desolate wastes of Siberia, Russia in Europe, and the wonderful industrial centres of Britain. The outstanding impression is the remarkable effects of applied science work. Unless a man believes in what he is doing there must be failure. Unless an engineer believes in the humanising results of his work, he will have no faith in it. Some of us think that "the white man's burden" is a thing which is real, a duty which must be cheerfully accepted. The reply to the short-sighted individuals who would stem the tide of scientific progress by the reiteration of the word "Materialism," is the humanising result of the Empire work done by engineers and clean administration in Egypt, India, the Straits Settlements, and other parts of the earth.

After one year we are able to show tangible results in Hong-Kong, but there must be no illusions that all is now finished. The writer will gladly receive further offers and reply very frankly as to whether they are acceptable. It is always possible to send subscriptions—we already find it necessary to extend our beautiful buildings; scientific appliances are also needed. It should be mentioned that Messrs. Matheson & Co., Ltd., 3, Lombard Street, London, have kindly arranged with the leading shipping companies to send all goods freight free. Messrs. Preece, Cardew and Snell are the honorary consulting engineers (London) for the University, and will advise as to details of equipment needed.

It has been possible to give the above record because of the far-sightedness and patriotism of the British engineering firms. It is an unanswerable reply to those who say that there is no enterprise in the old country. Good use will be made of the apparatus because the University is situated in a British colony; students are coming from all parts of the Far East. One man travelled for five weeks from the interior—and proved to be the best English scholar in the first year. He is the son of a wealthy official—in the "back of beyond"; a British Consul and a missionary schoolmaster trained him for years so that he might attend a British University. Six young engineers come from Yunnan—Government students from an interior province. They are seeing the oil engines, the dynamos, the wireless outfit and the machine tools. They will carry back into the interior the message that a knowledge of Science and Applied Science will prove a boon to China. And in Hong-Kong we also are sending a message throughout China—that the British Empire is not a thing decadent, as our trade rivals so constantly assert, but that the little islands in the West are still the nursing home of enterprise, good workmanship and scientific ability.

ELECTRICAL COMMERCIAL LABORATORIES.

ELECTRICAL engineering firms of any magnitude who have original work to investigate in the course of the development of their products, find it necessary to establish some form of research equipment which, under ordinary circumstances, would hardly be found on the premises of a manufacturing concern, as it would more usually belong to a college or technical institution. It is only, however, comparatively recently that it has been realised that in order to obtain the best and most accurate work, the research department should not be an afterthought, but should be carefully placed with relation to the commercial testing department and should be thoroughly well lighted, equipped and staffed. The results of such a policy have already been demonstrated in more than one prominent electrical manufacturing firm, as it has been possible to co-ordinate the research department not only with the test-room, but also with the drawing office and management sections. A considerable movement in this direction has taken place in the United States, and without attempting to cover the whole ground, two representative firms may be mentioned who have paid careful attention to this portion of manufacturing organisation.

The General Electric Co., of Schenectady, N.Y., commenced the movement in the direction of adequate research equipment by engaging Dr. Whitney, then Professor of Chemistry in the Massacheusetts Institution of Technology, to organise a department of chemical and physical research. The development and nature of the work carried out in this department have been well outlined in a paper by Christian Dantsizen in the *Journal* of the Worcester Polytechnic Institution for last year. The first laboratory was a small room 50 × 100 ft. long, and by September, 1901, 12 men were at work there. Congestion was acute, and a building 10 times the size was then used. Another change was necessary in 1904, and a third change was made some time later to the first two floors of an office building containing about 40 rooms, each 20 ft. square given to specialised lines of research. Each department was well lighted by windows and incandescent lamps, and piped for water, illuminating gas and hydrogen. Some of the rooms were also piped for nitrogen, oxygen, steam, vacuum and compressed air. Voltages varying from zero

to 6,600 volts, currents up to 200 amperes and power up to 150 KW. can be obtained in each room, and for special work higher voltages and currents can be secured. The generator room has a direct-current source of power supplied at 250 volts, converted by about 15 motor-generator sets varying from 5 H.P. to 200 H.P. direct current to different voltages and alternating current of various voltages and frequencies. A well-equipped machine shop and a chemical supply room are available, and the laboratory library has an extensive range of books and takes 64 periodicals dealing with technical subjects. The company also has a main library in one of its other buildings. Moreover, in addition to this special equipment, the laboratory can make use of the equipment of any other of the departments of the company. There is at present a staff of over 100 people in the research laboratory, including Dr. Whitney as director, Dr. W. D. Coolidge, assistant director, and about 50 college men. Not content with this, the company is now erecting a seven-storey red brick building in which the research laboratory and the standardising laboratory will be brought under the same roof. In this there will be an assembly room built after the style of a lecture room, where members of the research staff can assemble to discuss matters under investigation, and to listen to speakers from the various colleges, universities or another company.

The range of investigations has been enormous, including researches on electric furnace and other products, organic and inorganic insulating materials, metallurgical operations, electric lighting by means of incandescent lamps, luminous arcs and vapours. The metal tungsten was first produced in a high state of purity, so that it can be drawn into wire finer than any metal had before been drawn. The tungsten X-ray target, and the tungsten electric make-and-break contact were here invented. The Arsen vacuum furnace and the tungsten resistance furnace, both capable of maintaining a temperature of 3,000° C., are products of the research laboratory. The magnetic properties of iron and its alloys have been investigated, with the result that during the last eight years eddy-current and hysteresis losses in transformer steels have been greatly reduced. At present investigations are in progress as to the preparation and study of alloy systems for such purposes as obtaining high electrical resistivity, resistance to corrosion and definite coefficients of thermal expansion, the replacement of platinum by such metals as tungsten and molybdenum, the production of high-temperature resistance furnaces, the preparation of organic and inorganic insulators and the study of electrical methods of illumination by means of incandescent furnaces, arcs or gases. A capital of over $200,000 is annually spent on this laboratory, and the relation between the company and the investigator is simply that, provided the probable results are commensurate with the expenditure for carrying out a particular investigation, time and money are of no consideration.

Another good example is to be found in the equipment of the Allis-Chalmers Manufacturing Co., of Milwaukee. Without entering into much detail, it may be said that the commercial research laboratories of this company are divided into two divisions, electrical and mechanical. The electrical laboratory is also divided into two departments, one consisting of a general electrical laboratory, and the other a high-potential laboratory for the investigation of the insulating qualities of various insulating materials. The mechanical laboratory is also divided into two departments, one consisting of the chemical laboratory, and the other covering the testing of strength of materials and similar work.

The general electrical laboratory includes a complete equipment for the calibration and repair of all test meters, consisting of current and voltage batteries, standard shunts, standard meters and standard cells, together with the necessary switching apparatus for the calibration of the meters. This laboratory includes an equipment for the measurement of permeability by the ring method, using a ballistic galvanometer, and also apparatus for the measurement of iron losses according to the Epstein method. The insulation laboratory contains equipment for the performance of puncture tests from 800 volts up to 150,000 volts. This equipment consists of a motor-generator set with a specially-designed alternating-current generator giving a true sine wave and two high-voltage transformers, one with a range of 800 volts to 35,000 volts, and the other from 35,000 volts to 150,000 volts. This laboratory also includes an equipment for the measurement of the strength of tapes and webbings.

The chemical laboratory is equipped with all the necessary apparatus for the making of analyses of cast-iron, steel and all the alloys used in the manufacture, together with apparatus for the determination of the quality of different fuels, &c. The strength-of-material laboratory contains a Rheile testing machine of 100,000-lb. capacity, and also a spring-testing machine, transverse testing machine, &c. This covers the laboratory equipment of this company in a general way, and it will be seen that this type of laboratory lends itself to a good deal of original research.

It is not too much to say that equipments of this nature are absolutely necessary for the proper carrying out of engineering manufacture on anything like a large scale. As operations extend, the work becomes more and more differentiated until, as in the case of the General Electric Co., it becomes a paying undertaking to retain permanently the services of research experimentalists devoting their time entirely to the furthering of original developments which ultimately find their place in the patent records of the country. We are indebted to the officials of the companies mentioned for their courtesy in providing us with the information given above.

METER-TESTING RECORDS.

BY A. BILLINGTON EALES, Stoke-on-Trent.

IN view of the important functions which the supply meter is called upon to fulfil, and the influential manner in which the financial well-being of an undertaking is affected by the inaccuracy of such instruments, it is somewhat surprising that a more systematic method of test record keeping is not insisted upon.

Such a method need neither be cumbersome nor involve any great amount of labour in its upkeep. It is, however, essential that records be kept up to date to attain maximum efficiency with the minimum of labour.

Tests on supply meters are carried out, in the majority of cases, in a less perfunctory manner than obtained years ago, and, in order that the utmost value may be obtained from such tests, it is advisable that the results of observations made be noted in such a manner that reference to them can be made easily and without waste of time.

The system described is one devised by the writer, which has proved of considerable value during the two years or so that it has been in operation.

The results of tests taken on meters are entered in a book which is folioed for reference purposes. The ruling of the book is shown in fig. 1.

..... *Electricity Undertaking.*

METER TEST CERTIFICATE.

Meter No. Make. Amps. Volts. Cycles. Constant.

Load.	Power factor.	Watts.	Secs.	Revs.	Constant.	Remarks.

Meter registers with.....watts. Temp. .....

Last test No.....

Date..... 19..... Tested by.....

FIG. 1.

The most useful constant will probably be found when expressed as watt-seconds per revolution of the disk, or ampere-seconds per revolution in the case of the ampere-hour meters so largely used on direct-current circuits.

For continuous currents the second column in the Test Certificate Book should be omitted, and the word "amperes" substituted for "watts" in each case where the latter appears.

On completion of the tests a small label, which serve the dual purpose of identifying the owner of the instrument and carrying the number of the test certificate, is affixed to the meter case. This label may take the form shown in fig. 2,

"This instrument is the property of
the Electricity Undertaking.
Test Certificate No. ."

FIG. 2.

and, if printed on a small piece of thin card, may be firmly held by a piece of celluloid secured to the case with two bifurcated rivets or small bolts and nuts.

This label will enable the previous results obtained, when testing the meter, to be readily found, and also provides the information as to the number of the last test for any subsequent certificate.

In addition to the foregoing, it is often desirable to refer to the performance of a meter without facilities for the immediate inspection of the actual instrument. In order that the history of any particular meter may be traced, some means are necessary of indexing the certificate-books, so that, given the information as to a meter number, its make, size, type, and, where distribution is effected at more than one voltage, the pressure for which it is intended, the last test certificate number can be found. The information above mentioned is usually obtainable from the consumers' ledgers. Probably for this purpose a card system is one of the most useful.

For each meter a card is provided with the following ruling :—

Number.	Make.	Type.	Amps.	Volts.	Cycles.

Test No.	Sent to.	Address.	Date.	Returned.	Reason.

FIG. 3.

The guide cards for such an index should be marked with the standard ampere sizes of meters, separate drawers or divisions in the card index cabinet being provided for different voltages and frequencies. Cards should then be filed in the numerical order of the meters under the guide cards of their respective ampere capacities.

Such a card as that outlined above when read in conjunction with the test certificate book will give the complete history of any meter, with all its ailments from the time it was purchased.

This description is of a system intended to deal with the meter-testing records problem only, and is quite distinct from methods devoted to storekeeping and control of stock. It will be found of value in enabling central-station engineers to determine which type of meter is most suitable for its purpose, and most economical over its useful life.

In practice, it requires very little time for the various entries to be made, and the information provided is well worth the trouble involved.

Engine Starting by Electricity.—What is claimed to be the largest internal-combustion engine so far fitted with an electric engine starter has lately been completed by the Electric Launch Co., of Bayonne, New Jersey. It is a six-cylinder petrol motor of 175 H.P., one of six intended for that number of battleship tenders which that company is building for the U.S. Navy. After experimenting unsuccessfully with two other systems, the Rushmore Co., whose American works are at Plainfield, N.J., were approached, this concern installing on the engine one of their No. 1 dynamos and A 13 electric starters, driving the gear ring on the fly-wheel at a 12 to 1 ratio. The experiment proved so successful that the Electric Launch Co., which is one of the largest motor boat-building concerns in America, has decided to adopt the Rushmore system on all its engines. In the tests, with the engine new and very stiff, the starter succeeded in turning it at a speed of 126 R.P.M., on a consumption of 350 amperes, from a 12-volt 160-ampere-hour battery, corresponding to 4·35 H.P. delivered at the fly-wheel rim, the overall efficiency between the battery terminals and the fly-wheel working out at no less than 84½ per cent. When the engine had been well run in, and was warmed up, the starter was able to run it at 165 R.P.M., with a correspondingly reduced current consumption.

BRITISH PRACTICE IN THE CONSTRUCTION OF HIGH-TENSION OVERHEAD TRANSMISSION LINES.

BY B. WELBOURN, M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *January*, 1914.)

IN our large industrial centres, where electrical energy is usually conveyed to consumers by underground cables, it is frequently not realised what extensive use of overhead wires is being made in country districts for the same purpose. So far as can be ascertained there are already nearly 1,000 miles of overhead lines in the United Kingdom which are operated at alternating pressures between 2,000 and 20,000 volts inclusive ; and of these there are 115 miles in operation or under construction for 20,000-volt working.

Our longest direct transmission line is only about 20 miles in length, while one of 40 miles is under construction.

The following figures for three-phase transmission illustrate the saving in first cost between underground cables and overhead lines, for work of the highest class. Copper has been taken at £60 per ton, and lead at £20 per ton. The copper conductors comprise three of 0·10 sq. in. section in each case. No buildings, transformers, or switchgear are included.

Voltage.	Cable laid and jointed, including street work.	Overhead line of equal kilowatt capacity.
6,000	£1,400	£900
11,000	1,550	950
20,000	2,100	950

Incidentally, this table shows how little influence the working pressure has on the first cost of an overhead line in this country.

Through this cheapened means of transmission much electrification work is now being undertaken which would otherwise not be commercially possible. The extensive use of overhead lines has thus become of enormous benefit to the manufacturers of electrical plant, cables, and accessories, as well as to the supply authorities and their consumers.

The principal difficulty in pole-line work across country is that arising from the necessity of negotiating wayleaves, and these negotiations are frequently very prolonged.

The author thinks that a strong case has been made out to justify the Council of this Institution in making representations to the Board of Trade for the benefit of the electrical industry and all consumers with a view to removing the inconsistencies which exist in the law. At the same time, efforts should be made to secure a curtailment of the absolute veto on overhead wires by a local authority, and the local authority's refusal of consent should be made subject to an appeal to the Board of Trade. At present such an appeal is only allowed in regard to power companies' wires in *rural* districts.

To secure the best results, it is essential that the engineers should survey and set out the line and then prepare and issue to the constructional engineers a route plan giving all essential details of what is required. Fig. 1 gives a copy of such an actual plan which is a model of lucidity. Another essential is that the clerk of works should know his work and not be hampered by inelastic instructions. In making the survey of the line a useful instrument is Captain Abney's clinometer level fitted with a compass.

The following formulæ and particulars are in regular use in designing overhead lines and give very accurate results.

1. *To Find Current in Lines.*—Let W = watts to be delivered at far end of line ; V = voltage between outer wires at delivery end ; cos ϕ = power factor of the load ; I = current in amperes. Then—

$$I = W/V \cos \phi \text{ for single-phase lines,}$$
$$I = W/\sqrt{3}\, V \cos \phi \text{ for three-phase lines.}$$

2. *Voltage Loss.*—For short lines such as are used in the United Kingdom, capacity may be ignored and the formula $V_g - V$ will give the voltage loss.

$$V_g = \sqrt{(V \cos \phi + V)^2 + (V \sin \phi + E)^2},$$

where V_g = voltage at generator ; V_R = ohmic pressure drop in volts ; E = E.M.F. of self-induction.

In the short overhead lines used in this country the effects of electrostatic capacity may usually be ignored, and no account is here taken of it.

Safe currents for overhead wires are given by Prof. George Forbes's formula, $I^2 = D^3\, t\, \pi^2\, H/0{\cdot}96\, R$. D = diameter of wire in cm. ; H = coefficient of radiation = 0·0003 ; R = sp. res. of conductor per cm³ at limiting temperature ; t = temp. rise in degrees C. This is found to be very accurate in practice.

With one important exception, most of the high-tension lines have been built with creosoted wood poles. A representative example of an up-to-date line using wood pole supports is that erected from Scotswood to Burn Pit for the Newcastle-upon-Tyne Electric Supply Co., to the specification of Messrs. Merz and McLellan.

The main particulars of this line are as follows :—

System of working : Three-phase, 40 cycles, with earthed neutral.

Voltage between conductors : 20,000.

Voltage between conductors to earth : $20{,}000 \div \sqrt{3}$.

Conductors : Two horizontal circuits employing wires of

0·10 sq. in. section, arranged on the Merz-Hunter split conductor system.

Conductor spacing: 5 ft. horizontally, 5 ft. vertically.

Conductor sag at 60° F.: 5 ft. 6 in.

Average length of span: 85 yds.

Straight line poles: H-poles 32 ft. long and 10½ in. diam. at 5 ft. from the butt; 3 ft. 6 in. centre to centre of poles.

Channel arms on straight line poles: 10 ft. 6 in. long, 3½ in. × 2 in. × ¼ in. galvanised.

Terminal poles: H-poles 40 ft. long and 11 in. diam. at 5 ft. from the butt; 12 ft. centre to centre of poles.

Channels on terminal poles: 12 ft. 6 in. long, 5 in. × 2½ in. × ⅜ in. galvanised.

Corner poles: H-poles 40 ft. long and 10½ in. diam. at 5 ft. from the butt; 3 ft. 6 in. centre to centre of poles.

Channels on corner poles: 12 ft. 6 in. long.

Insulators on straight line poles: Petticoat pin-type well-cushioned from the metal pin by oiled-twine packing; on corner poles, do., with a second insulator.

Insulators on terminal poles: Suspension type, three in series.

Earthing arrangements: A continuous 7/19 S.W.G. galvanised-steel strand is run from end to end, and is connected to an earth plate every fifth pole. All metalwork on the poles is connected to this wire.

Telephone system: Four-pair telephone cable arranged for superimposed working is suspended from the continuous earth wire. Low-tension telephones are used.

Factors of safety: Strictly in accordance with the Board of Trade requirements of 1913.

Guarding: As shown later.

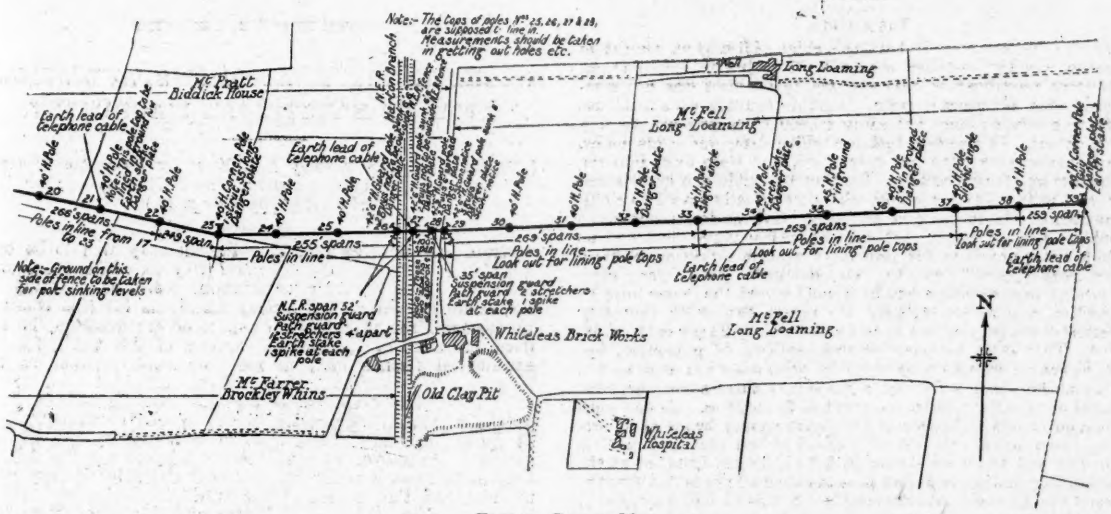
The most important lines in the United Kingdom on which steel towers are used are those of the Cornwall Electric Power Co., for whom Mr. J. S. Highfield is the consulting engineer. The North Wales Power Co. also have a few miles of lattice steel pole line. There is good reason to anticipate a life of 35 to 50 years for these poles if they are left undisturbed and if they are erected within a few months after creosoting. The reason for this is that the free creosote drains into the earth around the pole and forms an additional germicide protection.

In the last two years much interest has been taken in poles creosoted by the Rueping process, but naturally there is no experience yet of their life on the few lines which have been erected in this country. The poles have some advantages over Bethell poles in that they are both lighter in weight and cleaner to handle. From these points of view and in face of the experience obtained in other countries, poles treated by the Powell saccharine process must also be seriously considered in future.

To obtain the best results it is essential that all poles should be selected, dressed, slotted, bored, &c., at the maker's works before the creosoting is done. The maker should be supplied with detailed drawings showing the finished result required, and the inspection of the poles should take place at his yard whenever possible. When the poles are built up at the maker's works the key-block of A-poles and the brace-blocks of A and H-poles must be properly marked so as to ensure that they are put together correctly again on the site. Any recess cut in a pole after creosoting should be painted with hot tar. Some engineers have the bottom 9 ft. of the pole covered before erection with a preservative mixture consisting of 1½ parts each of Stockholm tar and slaked lime and 7 parts of well-boiled gas tar.

Steel structures before delivery should be coated with bitumastic solution; and on that part of the structure which carries the insulators and so normally is inaccessible with safety, the members should also be galvanised before applying the solution.

The choice between steel and wood poles is mainly a question of first cost plus maintenance charges. In the industrial districts of this country there are many reasons why pole lines cannot be run in a straight line, with the result that the spans usually do not


Note:- The tops of poles Nos 25, 26, 27 & 28, are supposed to be in a straight line in Measurements should be taken in getting out holes etc.
Long Loaming
Mc Pratt Biddick House
Earth lead of telephone cable
Mc Fell Long Loaming
Earth lead of telephone cable
40 H Pole
40 H Pole Large Plate
40 H Pole Large Plate
40 H Pole Large Plate

nozzling off. The stay wire should be taken three times round the pole or, alternatively, galvanised iron plates should be fitted to wooden poles, at the point where the stay is fixed, to prevent cutting into the wood. The stay should be taken round a galvanised thimble at the stay-rod end. All stay wires should be connected to the general earthing system of a line; but when lines are run in mountainous country, where it is difficult to obtain good "earths," it is advisable to insulate the stay-wire near the pole by inserting in it an insulator of the tramway globe strain type.

Sometimes it is necessary to put fore and aft stays on poles, *e.g.*, where a line is liable to be damaged by aeroplanes. Selected poles should have stays in the direction of the line whenever the line makes any considerable variation in level. On unenclosed land, so as not to cause injury to animals, all stay-rods should be protected by means of wooden cattle-guards securely fixed and painted white to make them easily discernible. It would be better to treat them by the Burnett or Powell processes before painting. The creosoting of cattle guards is a mistake in such cases because they cannot then be painted. In all other cases the cattle guards should be preserved by creosoting them.

The nozzles of all stays should be protected from corrosion by being coated with a high-grade bitumastic paint, and unless the threads of all stay-rods are galvanised they should be painted with a mixture of 45 parts tallow, 45 parts coal-tar, and 10 parts of mineral pitch, as soon as practicable after installation, to prevent them rusting up and becoming useless.

After having erected and watched the behaviour of about 500,000 yards of aluminium conductors (chiefly on low-tension lines), the author is very decidedly of the opinion that this metal ought not to be passed over in favour of copper if the total first cost of a line comes out cheaper with aluminium. There are cases where sulphur products abound, *e.g.*, in the neighbourhood of coke ovens, where aluminium should be preferred to copper because it will not be so readily corroded.

(*To be continued.*)

Discussion.

Dr. C. C. Garrard said that the chief difficulty at present in America was the so-called corona loss; owing to the different conditions prevailing in this country, this subject was not mentioned in Mr. Welbourn's paper. In this country we should not have transmission lines exceeding 20,000 volts pressure, to any large extent. In a certain instance which came under his notice, the insulator pins were not galvanised, and were fixed into the insulators by litharge cement. Continual trouble was experienced due to the insulators cracking, which was finally traced to small quantities of rust forming on the pins. Galvanising got over the trouble. The statement that even at 20,000 volts there was no need to make provision for protection against lightning where a cable was "teed" on to an overhead line was most important, as the opinion had been put forward that some form of protection was necessary here. He agreed that horn lightning arresters could only relieve a surge voltage by 20 per cent. of its value. They were a somewhat crude method of protection, but very cheap. The resistance in series with a horn arrester should be about 50 ohms, which, on a 6,600-volt three-phase line, with neutral earthed, would give a current of 76 amperes. To deal with such a current, a liquid series resistance should be installed preferably to a carbon rod. Steinmetz had shown that with such a horn-gap and series resistance, with a choke coil installed at the transmitting station, a higher pressure than 50 per cent. above the normal could not get into the station. A general condemnation of spark-gaps in connection with arresters was not permissible. The aluminium lightning arrester which had been used extensively in America, although originally invented in this country, had a spark-gap, and very excellent results were claimed for this arrester. The Giles valve, which was made by the same manufacturers that made the Moscicki condenser, also contained spark-gaps, and gave very good results for the protection of machines. Condensers had given satisfactory results where all other systems had failed. A short-circuit current was very much larger in the first instant than it was, say, one second after the short circuit came on. As with the continual increase of size of generating and distributing systems, the breaking capacity of the oil switch became a limiting feature, it was important that an instantaneous disconnection of a short circuit should not be possible.

Mr. F. J. Moffett said the present state of the law regarding wayleaves was a very serious handicap to electrical development generally. It was the duty of the Institution to see that in the matter of legislation, this country should be freed from such disabilities and put on a level in this respect with other European countries. Wooden poles properly treated with creosote were the most suitable for all positions except where appearance was a consideration. A few years ago he examined some poles which had been erected over 40 years, and which were being removed to allow of heavier poles being substituted; they were in very good condition, including the part below the ground. In many industrial districts, such as the Black Country, the air was so laden with acid that the life of iron or steel was short unless care was taken periodically to coat it with some preservative such as coal tar or bitumastic paint. Aluminium was now in respect of corrosion on quite equal terms with copper; the twisted sleeve joint was simple and fairly satisfactory. He had found that the most effective method of tying in the line wire was first to cover it with a lapping of soft copper tape and tie it in with a soft copper binder. He did not agree with the author in his dislike of any form of lightning arrester involving a spark gap. Several years' use of Wurtz multiple air-gap arresters on overhead lines had convinced him that they formed an efficient protection. These lines were erected in Nigeria, where thunderstorms were much more violent and frequent than in this country. No choking coils were used in connection with these arresters, but no damage was ever done to machine windings or switchgear.

Mr. L. F. Mountford was surprised to hear that the author did not believe there was any necessity for placing the aerial earth wire above the power wires as a protection against lightning. He thought it was decidedly useful in this respect, although it should be of the same material as the power wires, not only on account of its longer life, but also on account of its greater conductivity. He regretted that the author had been so severe in his condemnation of spark-gaps. His 6,000-volt lines were protected with arresters of the "multigap" or "low equivalent" type, where they entered the sub-station and choking coils of wrought-iron were placed in each line. This apparatus had given no trouble since its installation, and spark-gap arresters were installed in all the sub-stations on the 2,000-volt system. It seemed probable that the spark-gap arrester found its chief usefulness in systems of moderate voltage—6,000 to 10,000; beyond this the number of gaps required made the apparatus somewhat cumbersome, and it would probably be better to employ electrolytic or other forms of condenser arrester. With regard to the method of protecting the apparatus in the station by placing extra insulation on 10 per cent. of the windings on the line side of the transformers, there did not appear to be any reason why a fixed percentage of the end turns should be reinforced in this way. This would appear to depend upon the voltage of the supply, as a transformer of comparatively few turns would probably have the impact stress of a surge distributed over more of its windings, while one of many turns would only be stressed through a small percentage of its windings. One objection to this method of protection appeared to be that it protected the station, but not the line, and as a punctured insulator generally meant a shut-down, it would seem advisable, in cases where continuity of supply was important, to install some form of protection for the line as well.

NOTES ON INTERNATIONAL STANDARDISATION OF ELECTRICAL MACHINERY.

(*Discussion on paper read by* A. R. Everest *before the* Institution of Electrical Engineers *at Birmingham; for abstract of paper see p. 36.*)

Mr. C. le Maistre said that the industry was to be congratulated upon the public-spirited way in which the manufacturers, through their association, were co-operating in the establishment of satisfactory standards for this country. As regarded the international aspect of the question, he felt quite confident of the ultimate success of this work, for our continental friends had, in just the same manner as the English and Americans, placed their very best men at the disposal of the Commission for the working out of these problems, and the delegates to the special committee, both at Zurich and at Berlin, were all actuated by the highest motives. Whatever standards were adopted by the I.E.C., they must be of a really international character if they were to command the respect of the world, and the interests of those countries which were hotter or colder than temperate climates must carefully be borne in mind. As general secretary of the Commission, he was debarred from entering into any detailed criticism of Mr. Everest's very admirable notes, but he could assure the meeting that the Central Office in London of the I.E.C. would do everything in its power to help forward international agreement on this important subject. To be able equitably to compare different tenders must be of such material advantage to the progress of international trade in electrical machinery, that it was well worth striving for.

Dr. C. C. Garrard could not quite understand the lengthy arguments which had been put forward with regard to the reference, or standard, air temperature. It seemed to him this was only a roundabout, and somewhat confusing, way of fixing the standard temperature rise. It was clear, as it had been granted that the temperature of the cooling air during test was without effect on the temperature rise, that machines could only be compared with each other on the ground of temperature *rise*. Some people had gone to great trouble to make meteorological investigations all over the world, but this was absurd, since much greater variation of temperature might be found in one building, or ship. The idea appeared to be prevalent that having fixed the limits of observable temperature, it was possible to devise a rating which would ensure that this permissible temperature would never be exceeded. This was clearly impossible. The real question was shall the standard temperature rise be say 60° or 50° C.? Having fixed this, all machines built to this rating would be directly comparable, and instead of there being several I.E.C. ratings, viz., temperate zone, torrid zone and arctic zone, there would only be one rating, as of course there must be if it was to be an international rating. The table of limits of observable temperature would then be very useful to the user in determining what machine to use in any given circumstances. It was not possible to fix any standard rating so that the purchaser would be safe

to install a machine, purchased as being in conformity with such standard rating, in any position. Such action would have the result that in a hot location, where the factor of safety should be higher, it would be, in fact, lower than in a colder situation. It would be much better to make it quite clear that they were simply aiming at fixing an international standard of temperature rise and that there would not be several I.E.C. ratings but only one.

Dr. T. F. WALL said that the most important point under discussion was the question as to the temperature the cooling air was to be assumed to attain in any temperate zone in order that the temperature rise allowed by the I.E.C. might be consistent with the limiting values given in the table. On looking at this table he was struck by the very high values allowed for the limiting temperatures. In view of the data given in Mr. Rayner's paper of 1905, he thought there was not much margin of safety when the values given in the table were adopted, and these values should on no account be exceeded. Certainly the highest temperature likely to be experienced in any temperate climate should be taken in conjunction with the table to fix the temperature rise. If a temperature of 40° C. was not uncommon, then if the value of 35° C. were taken as fixing the permissible value, the temperature given in the table would in some cases be exceeded, and the danger zone would be reached. He approved of the rating of motors in kilowatts instead of horse-power.

Dr. G. KAPP, referring to the decision of the I.E.C. not to establish any rules for correction for ambient temperatures or altitude, remarked that the influence of density of cooling medium was exceedingly complex, and this might account for the discrepancies between the experiences of different observers. It was not the volume, but the weight of air and the velocity at which it passed along the surfaces which determined the amount of calories it could take away. It was quite conceivable that no material difference in the temperature rise would be observed, whatever (within reasonable limits) was the density of the air. The adoption of 40° as advocated by the British and American members of the I.E.C. was not unreasonable, when one came to consider the necessity of providing a certain factor of safety. The yield point in the stress of a bar of steel could be found with a fair degree of accuracy, but the thermal yield point of any particular type of insulating material was not so accurately known. That such a point existed had been shown by Mr. Rayner and later by Dr. Steinmetz and the brilliant group of American engineers working on this subject. All experts agreed that 5° to the one side or the other made all the difference between a long and a short life of the insulation. The I.E.C. had agreed on certain upper limits of "observable" temperatures; these values were probably not very far from the yield points, and for this reason they must not be overstepped. It was therefore a wise precaution to agree on an ambient temperature sufficiently high to ensure that these maximum temperatures should not be exceeded even on a hot summer's day. The cost of machines was only slightly increased by adopting the ambient temperature of 40° as a starting point to arrive at the permissible rise, whilst the extra security against breakdown and the consequent possibility to reduce the amount of spare plant was certainly in the interest of the user. Nowadays, when electricity had become so important a factor in all industries, electrical engineers must not run any avoidable risk, and even if the provision of a generous factor of safety should make a machine a few per cent. dearer it was in the long run in the interest of the user to pay a little more for a reliable article rather than a little less for a cheaper and unreliable article. This was the policy followed by the best English and American practice, and they could wish for nothing better than that it should become the policy of electrical engineers of all countries.

Mr. H. R. HUDSON referred to the employment of fans on the rotating parts of ordinary "protected type" and "enclosed ventilated type" industrial motors. Every designer was familiar with the reduction in cost for a given temperature rise which was obtained by the use of well-designed fans on the revolving parts of motors of normal speeds, and this without appreciable reduction of efficiency. Unfortunately, in five cases out of six, motors were installed in such positions and under such conditions that after a few months' running the ventilating passages and the interstices between the armature coils of a fan ventilated motor were so clogged with dirt, that if a full load test were taken, the maximum temperature rise would be found to be 10 to 15 per cent. higher than when first installed. This was not the case with machines relying on natural ventilation. Hence specifying I.E.C. rating would *not* in all cases establish a standard of quality as regarded temperature or life, unless accompanied by some proviso that the temperature limits should not be exceeded when the machine was tested after a certain period of running under actual service conditions. Such an arrangement would, of course, be commercially out of the question. He thought that in the interests of the buyer and also from the point of view of placing all manufacturers, of whatever nationality, upon an equal footing when quoting for enclosed ventilated machines, it was most desirable that machines with natural ventilation should not be placed in the same category as machines with fan ventilation. The matter seemed to him to be quite as important as discussing whether the maximum air temperature in the temperate zone should be taken as 35° C. or 40° C. He sincerely hoped that the I.E.C. would give the subject of the definition of types of electrical machines its earnest consideration.

Mr. C. T. SIEBS thought it was very much to be desired that some definite rule should be fixed, standardizing the exact method of measuring the temperature rise of various parts of machines. Unless this was done the manufacturer who based his guarantee on a temperature rise by the increase in resistance method would be handicapped in comparison with a manufacturer who based his guarantee on the temperature rise by thermometer. It was to be hoped that the tendency would be towards the use of thermometers for determining temperature rise rather than the increase in resistance method, as thermometric readings were invariably preferred by customers. In the table of limits of observable temperature, commutators and sliprings were bracketed together with a final permissible temperature of 90° C. The mechanical construction of sliprings usually took the form of a bronze ring shrunk on to a mica-insulated cast-iron hub. With such construction, a very high temperature was possible without fear of the rings becoming affected, whereas with commutators of the usual construction it was extremely difficult to obtain anything like equal expansion of all parts, with the result that a high temperature rise on commutators was to be deprecated, as trouble might then be expected with high bars, loosening, etc. The I.E.C. had not made any attempt to define rules for sparking limits of direct-current machines. This was quite as important as the standardization of safe temperature limits, and would be more necessary now than ever, if the overloads at present universally given with such machines were excluded. There were many cases where direct-current machines were called upon to give a very heavy output for such short periods that the temperature rise did not enter into the calculations, the limits being sparkless commutation and mechanical strength. Rating the motors on a kilowatt instead of a brake-horse-power basis would undoubtedly only help to confuse consumers, who very often had a fair idea of the brake-horse-power required but would regard a kilowatt rating as meaningless.

Mr. N. B. ROSHER pleaded that the rating of machines should be no higher in the future than at present. If the I.E.C. ultimately adopted 40° C. as the ambient temperature, the rating of machines would be considerably higher than at present. His objection to the higher rating was chiefly that a very large percentage of motors used for industrial purposes drove line shafting, to which additional machines were frequently added. If the motors used for these purposes were highly rated there would not be the same margin of power as at present. With regard to the table of limits of temperature, it seemed to him very undesirable that the figure for bearings should be as high as 80° C. in the case of motors installed in out-of-the-way positions or where an inspection was made at only infrequent intervals.

Mr. W. J. LARKE said it was of the utmost importance that an international agreement should be arrived at in connection with standardization, in the interests of the development of the electrical industry throughout the world, as well as of foreign business in the countries which did not produce their own electrical machinery and apparatus. In these latter countries we had for some considerable time been at a serious disadvantage with our German competitors, due to the adoption in this country of a more conservative basis of rating. But the work of the I.E.C. would prove abortive unless each country represented on it took the requisite steps to ensure that the recognised authorities in that country, controlling the standards of the industry, co-operated with the I.E.C. by changing where necessary the recognised standards of the country to those formulated by the I.E.C., to which their representatives had subscribed. For the United Kingdom this authority would presumably be the Engineering Standards Committee. In America the Institute of Electrical Engineers had already drafted a comprehensive series of rules in which had been incorporated the standards formulated by the I.E.C., so far as these had been established by international agreement. On the question of the temperature of the surrounding air rested the whole problem of international standardization in the rating of electrical machinery. There was no doubt that the attitude of the British and American delegates was correct in supporting such a limit for the ambient temperature as would ensure, under the conditions of climate considered, that the maximum limits of temperature mentioned in the table were never exceeded during any period of the working time, and this was the only logical attitude, in view of the fact that the limits mentioned were the maximum. It was to be hoped that at the next meeting of the I.E.C. the 40° limit would be agreed upon, the arguments in its favour being irrefutable. If 40° C. were adopted for temperate zones, there would arise the difficulty of rating of machines exported to tropical zones. Whereas large machines were almost invariably specially designed and built for the conditions under which they were required to work, a difficulty arose as to the rating of the small machines, which it was desired to deliver from stock for shipment to tropical zones. It seemed evident that in every case the ambient temperature of the locality in which the machines were to be used must be taken into consideration, and the machines re-rated accordingly by the manufacturer supplying them. The suggestion that motors should be rated in kilowatts

instead of H.P. was an innovation for which there seemed no reasonable grounds, and one that would be fraught with the greatest possible difficulty and inconvenience. From a considerable experience and acquaintance with users of electrical machinery, it might be definitely stated that the difficulties of introducing electric driving, particularly to small users, would be considerably enhanced by following this procedure. All prospective users of electric power thought in H.P., and the prime mover, of whatever type, which it was proposed to supersede by an electric motor, was invariably rated in H.P.

Dr. M. KAHN said there could not be any doubt that a conservative rating was to the best advantage of all concerned. There was no question that machines sometimes had to run in temperatures of surrounding atmospheres of 40° C. Usually machines would run in temperatures of about 25° C., and the difference of 15° C. could be taken as a certain safety factor. It would be impossible to persuade a customer who had been used up to now to buy a 20-H.P. motor and get a certain load out of it and have something in hand for contingencies, that in future he would have to specify a maximum load, with a certain margin above the normal load. This could be obviated if the rating of the motor were settled in such a way that in case the rating allowed was exceeded by a reasonable limit no harm would be done to the machinery installed.

Mr. H. M. HOBART sent a communication to the following effect:—In the preliminary draft of a pending revision of the A.I.E.E. Standardization Rules, the plan has been followed of adhering to the I.E.C. Rules to the extent to which the latter have now been completed, and to incorporate their spirit in dealing with the classes of machines and the various features for which they do not yet provide. The draft divides rotating machinery into two groups—machines for pressures up to and including 4,000 volts, and those for pressures above 4,000 and not exceeding 14,000 volts. It is assumed that there will be places in these machines where the insulation will be subjected to temperatures exceeding by 10° and 20° respectively the highest temperature which can be "observed" with the methods of measurement recognised in the Rules. For stationary transformers, the internal drop in temperature is assumed to be 10°, irrespective of the pressure for which the transformer is wound. In the preliminary draft the I.E.C. values for the highest permissible limits of "observable" temperature have been adopted. These values represent approved practice for continuous running, if associated with such provisions as shall insure that they are *never* exceeded. For the A.I.E.E. Rules, the prospective International Ambient Temperature of Reference of 40° is adopted. Data of *shade* temperatures from all over the temperate zone afford ample evidence that no lower value could be adopted consistently with the International recommendation that the Standardized limits of "observable" temperature shall *never* be exceeded. This recommendation has already been incorporated in paragraph 18 of the new Standardizing Rules of the Verband Deutscher Elektrotechniker. Since the approved "observable" temperature rises set forth in the V.D.E. Rules are values, which, when added to 35°, give the highest permissible "observable" temperatures, it is clear that when the ambient temperature is greater than 35°, the highest "observable" temperature will be exceeded by an equal amount. In the neighbourhood of electrical machinery, the ambient temperature is frequently between 35° and 40°; to *declare* it to be 35° is futile if (as is the case) it *actually attains* to values several degrees greater, since this will occasion the temperatures corresponding to approved practice to be exceeded at times by several degrees, which conflicts with the International Agreement that the approved "observable" temperatures are to be considered as values which shall *never* be exceeded.

FARADAY SOCIETY.

SEVERAL discussions of varied interest were the features of the last meeting of the FARADAY SOCIETY, held on November 26th, at the Institution of Electrical Engineers. Several of these were of somewhat abstract interest but a few remarks on two or three others will not be out of place here.

THE DENSITY OF ALUMINIUM. DR. F. J. BRISLEE had shown in a paper presented to the Society in May, that contrary to what one would imagine, rolling and otherwise working aluminium reduced instead of increasing its density, the density, however, increasing again when the metal was annealed. Photomicrographic examination showed that the diminution in density was accompanied by a disappearance of crystalline structure, the polyhedra of the cast metal passing into an amorphous or vitreous state. Annealing transformed the amorphous back again into the crystalline state, with the accompanying increase of density already referred to. The changes of volume are a little difficult to understand thermodynamically, and the hope was expressed that the matter would be further investigated. It is necessary to know, for example, whether aluminium gains or loses heat when it is rolled and indeed the whole question of the change of state of aluminium, if there be such change of state, needs systematic investigation before the observations made by Dr. Brislee can be properly understood. Needless to say the question is of technical importance as well as of theoretical interest, particularly in view of the differences which exist in the stability of the hard-worked and annealed metal.

OVERVOLTAGE. A note by Professor J. W. RICHARDS of Lehigh University, U.S.A., which appeared in the last issue of the Society's *Transactions* led to a short discussion on this somewhat elusive subject. Professor Richards put forward the novel view that overvoltage was not of the nature of a decomposition voltage and that it did not do chemical work. Calorimetric tests on a voltaic cell led him to believe that it is nothing more than a surface resistance caused by the accumulation of gas on the electrode, so that all the energy absorbed appears as sensible, measurable, heat. This view was strongly opposed by Dr. F. J. BRISLEE and by Mr. U. R. EVANS, who reiterated the orthodox theory that overvoltage was simply due to the fact that the formation of visible bubbles required a considerable degree of supersaturation of the kathode with hydrogen, analogous to what happened when a liquid was superheated.

NITROGEN AND THE ELECTRICAL DISCHARGE. Dr. T. MARTIN LOWRY showed a series of photographs illustrating the formation of an oxidizable variety of nitrogen by the combined action of a so-called "silent" discharge and a "spark" discharge in air at atmospheric pressure. The observations arose out of experiments made with gases for bleaching flour. The new allotropic variety of nitrogen has the property of being oxidised by ozone to nitrogen peroxide. If no ozone is present the gas quickly reverts to the ordinary form. The existence of this allotropic nitrogen may have some bearing on the technical fixation of nitrogen, and it is suggested that the oxidizable variety is first formed by the discharge and afterwards oxidised by means of the ozone formed simultaneously to the oxides of nitrogen. The chemically active variety of nitrogen recently discovered by Strutt under certain conditions of vacuum discharge would appear to be different to Dr. Lowry's variety, as it is not oxidizable by ozone.

TRADE STATISTICS OF SIAM.

The following figures showing the imports of electrical and similar goods into the port of Bangkok during the year ended March, 1912, are taken from the recently issued official trade statistics; the figures for the year ended March, 1911, are included for purposes of comparison and notes of any increases or decreases are given. Imports stated to be from Singapore and Hong Kong are for the most part the products of other countries shipped *via* these two ports.

	1910-11. Ticals.	1911-12. Ticals.	Inc. or dec. Ticals.
Electrical goods and apparatus.—			
From United Kingdom...	197,000	315,000	+ 118,000
,, Germany	151,000	407,000	+ 256,000
,, United States ...	44,000	101,000	+ 57,000
Singapore ...	12,000	15,000	+ 3,000
,, Sweden	—	14,000	+ 14,000
,, Hong Kong ...	—	10,000	+ 10,000
,, Italy	10,000	7,000	— 3,000
,, Austria	2,000	3,000	+ 1,000
,, Holland	10,000	10,000	—
,, France	14,000	4,000	— 6,000
,, Japan	1,000	6,000	+ 5,000
,, Other countries ...	11,000	4,000	— 7,000
Total ...	452,000	896,000	+ 444,000
Hardware, etc.—			
From Singapore ...	251,000	205,000	— 46,000
,, United Kingdom...	197,000	245,000	+ 48,000
,, Germany	248,000	381,000	+ 133,000
,, Austria	104,000	112,000	+ 8,000
,, United States ...	64,000	43,000	— 21,000
,, France	32,000	31,000	— 1,000
,, Switzerland ...	19,000	6,000	— 13,000
,, Other countries ...	169,000	125,000	— 44,000
Total	1,084,000	1,148,000	+ 64,000
Lamps.—			
From Singapore ...	71,000	49,000	— 22,000
,, Hong Kong ...	26,000	27,000	+ 1,000
,, United Kingdom...	21,000	36,000	+ 15,000
,, Germany	33,000	69,000	+ 36,000
,, United States ...	63,000	74,000	+ 11,000
,, Japan	56,000	71,000	+ 15,000
,, Other countries ...	7,000	29,000	+ 22,000
Total ...	277,000	355,000	+ 78,000

	1910-11. Ticals.	1911-12. Ticals.	Inc. or dec. Ticals.
Parts of lamps.—			
From Singapore ...	19,000	13,000	— 6,000
„ Hong Kong ...	21,000	7,000	— 14,000
„ United Kingdom...	22,000	17,000	— 5,000
„ Germany	9,000	12,000	+ 3,000
„ United States ...	10,000	3,000	— 7,000
„ Other countries ...	12,000	11,000	— 1,000
Total ...	93,000	63,000	— 30,000
Steam machinery other than milling and marine.—			
From United Kingdom...	53,000	70,000	+ 17,000
„ Germany	8,000	35,000	+ 27,000
„ United States ...	32,000	9,000	— 23,000
„ Other countries ...	5,000	6,000	+ 1,000
Total ...	98,000	120,000	+ 22,000
Machinery other than steam.—			
From United Kingdom...	154,000	156,000	+ 2,000
„ Germany	37,000	56,000	+ 19,000
„ United States ...	81,000	26,000	— 55,000
„ France	6,000	30,000	+ 24,000
„ Other countries ...	17,000	27,000	+ 10,000
Total ...	295,000	295,000	—
Machine belting.—			
From United Kingdom...	81,000	34,000	— 47,000
„ Germany	18,000	27,000	+ 9,000
„ Other countries ...	5,000	1,000	— 4,000
Total ...	104,000	62,000	— 42,000
Brass and brassware.—			
From Hong Kong ...	454,000	255,000	— 199,000
„ United Kingdom...	66,000	71,000	+ 5,000
„ China	34,000	167,000	+ 133,000
„ Germany	11,000	23,000	+ 12,000
„ Japan	3,000	19,000	+ 16,000
„ Other countries ...	24,000	20,000	— 4,000
Total ...	592,000	555,000	— 37,000
Copper and copper ware.—			
From Hong Kong ...	105,000	23,000	— 82,000
„ United Kingdom...	24,000	21,000	— 3,000
„ China	5,000	27,000	+ 22,000
„ Other countries ...	8,000	13,000	+ 5,000
Total ...	142,000	84,000	— 58,000
Iron and steel wire manufactures.—			
From United Kingdom...	35,000	37,000	+ 2,000
„ Germany	12,000	29,000	+ 17,000
„ Switzerland ...	4,000	2,000	— 2,000
„ Other countries...	14,000	20,000	+ 6,000
Total ...	65,000	88,000	+ 23,000
Railway material.—			
From United Kingdom...	205,000	149,000	— 56,000
„ Germany	158,000	236,000	+ 78,000
„ Belgium	316,000	294,000	— 22,000
„ Other countries ...	2,000	3,000	+ 1,000
Total ...	681,000	682,000	+ 1,000

NOTE: £1 = about 13 ticals.

ELECTRICAL BILLS IN PARLIAMENT.

ESTIMATES OF EXPENDITURE.

The estimates deposited in connection with the Private Bills which will come before Parliament in the forthcoming session give the following amongst other expenditure:—

Reading Corporation (Mr. G. F. Craven, Tramways Engineer)—Construction of tramways, £3,100; provision of trolley vehicles, £6,800; provision of electrical equipment and other works necessary for tramways and trolley vehicles, £6,000; motor omnibuses, £3,500; Depôt accommodation, £2,400 ... ... £21,800

Cleckheaton Urban District Council (Mr. Clifton Lund, engineer).—Six motor omnibuses, £4,800; land and construction of buildings, £1,400 ... £6,200

London County Council (Mr. G. W. Humphreys, engineer).—Tramways, £129,000; street widenings and improvements, £89,500 ... ... £218,500

Aberdeen Corporation (Mr. W. Dyack, engineer).—Double tramway, 4 furlongs 4.15 chains, £7,240; double tramway, 6 furlongs 1.42 chains, £12,990; double tramway, 5 furlongs, 0.33 chains, £9,270; street improvements, £5,000 ... £34,500

Walsall Corporation (Mr. J. Taylor, borough engineer).—Steelworks, £5,634; construction of 1 furlong 8.18 chains of double tramway, £3,062; electrical equipment, £523; tramway rolling stock, £9,000; provision of trolley vehicles, £16,500; electrical equipment, etc., of trolley vehicles, £27,871; motor omnibuses, £19,800; land, £500; building of trolley vehicles and 'buses, £3,000 ... ... £85,890

Glasgow Corporation (Mr. J. Ferguson, engineer).—For the construction of twenty-eight sections of tramway £406,500

Newcastle-on-Tyne Corporation (Mr. W. J. Steele, engineer).—Tramway, 3 miles 1 furlong 4.7 chains. single, £36,180; tramway, 8 chains, single, £1,457; tramway, 1 mile 1 furlong 7.3 chains, single, £15,534; other works, £2,200 ... £55,371

Bolton Corporation (Mr. E. L. Morgan, borough engineer).—Tramways £30,242

Leeds Corporation (Mr. J. B. Hamilton, tramways general manager).—Construction of tramways, £60,011; provision of trolley vehicles, £12,000; provision of electrical equipment, etc. for tramways and trolley vehicles, £28,562; land for substation and depôt, £475; provision of sub-station and depôt and plant and cables in connection therewith, £42,161 ... ... £143,210

York Corporation (Mr. J. W. Hame, electrical engineer).—Provision of trolley vehicles, £9,800; electrical equipment, £8,648; provision of equipment of motor 'buses, £12,000; land and depôt for trolley vehicles, etc., £21,617 ... ... £52,065

Birmingham Corporation (Mr. H. E. Stilgoe, city engineer).—Construction of new tramways, £144,209; overhead equipment and electric feeders, £34,917; rolling stock, £18,000 ... ... £197,126

Sheffield Corporation (Mr. C. F. Wike, city engineer, and Mr. A. R. Fearnley, tramways manager).—Construction of tramways, £2,055 .... £2,055

Chesterfield Corporation (Mr. R. L. Acland, borough electrical engineer).—Tramway, 3 furlongs 0.03 chains, £3,900; tramway, 3 furlongs 2.73 chains, £4,100; underground feeding cables, etc., £3,000; six double deck cars, including motor and other electrical equipment, £5,100; extension of car shed, £1,500; alteration to postal telegraph wires on route, £500; contingencies, £400 ... ... £18,500

Norwich Electric Tramways (Messrs. I. E. Winslow and T. Hennell, engineers).—Construction of tramways, £30,360; street works, £5,038 ... £35,398

Newport Corporation (Mr. H. Tremelling, engineer).—Construction of tramways, £7,250; purchase of motor 'buses and provision of depôt, etc., £6,000 ... ... £13,250

Deal and Walmer Gas and Electricity (Mr. Percy Griffith, engineer).—Construction of railway and bridge, £2,018 ... ... £2,018

Preston Corporation (Mr. J. Barrow, engineer).—Construction of tramways, £26,000 ... ... £26,000

Clyde Navigation (Mr. W. M. Alston, engineer).—Diversion of Glasgow Corporation tramways in Renfrew Road, £17,291; diversion of post office telegraph lines and cables, £3,300; construction of dock tramways, £19,295 ... ... £39,886

Great Yarmouth Haven Bridge and Tramways (Mr. J. W. Cockrill, borough surveyor).—Tramways £8,443

London Electric Railway (Mr. H. H. Dalrymple Hay, engineer).—Construction of five subways £100,276

North and South Shields Railway (Mr. J. Portsmouth, engineer).—Construction of 6 furlongs 6.80 chains of railway under the Tyne £187,986

Metropolitan and Great Northern Railway Co. (Messrs. W. Willox and C. J. Brown, engineers).—Construction of railways, £711,409 ... £711,409

Central London Railway (Messrs. Mott and Hay, engineers).—Enlargement of tunnels, £86,140; subways, £68,850 ... ... £154,990

Birkenhead Corporation. — Provision of motor omnibuses £20,000

Bournemouth and District Railless Traction.—Capital powers, £10,000 ... ... £10,000

Manchester Corporation.—For land, easements and works for supply of electricity, £50,000 ... ... £50,000

Skegness Urban District Council.—For land and erection of electricity station, £1,263; laying of electric mains, £7,471; purchase of motor 'buses, £1,800; car shed and depôt, £900 ... £11,434

St. Anne's Urban District Council.—Motor omnibuses, £800; land and depôt, £900 ... ... £1,700

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

GREECE.—The Board of Trade have received information from H.M. Ambassador in Greece to the effect that a Bill providing for important reductions in the Greek rates of Customs duty has been introduced into the Legislature. The proposed reductions will not take place until the Bill is enacted.

AUSTRALIA.—The Commission which has been appointed to inquire into the working of the tariff has received applications for the extension of preference to British goods in the following lines:—Regulating, starting and controlling apparatus for all electrical purposes, including distributing boards and switchboards, except telephone switchboards (present duty 20 per cent. from all countries); electric fittings consisting wholly or partly of metal, viz., switches, fuses, and lightning arresters (at present free from all countries); telephones, switchboards and appliances (at present free from all countries). These applications have been made in accordance with the proposals to which reference was recently made in a leaderette in the ELECTRICAL REVIEW.

FRANCE.—The Board of Trade have received information to the effect that pending further consideration by the French Government, of certain new regulations with regard to the marking of merchandise imported into France, importers may, on application to the French Customs authorities, continue their existing practice in the matter. This privilege does not, however, extend to marks, the illegal character of which has already been determined.

SALVADOR.—The Consul-General of Salvador in London has issued a statement to the effect that from January 1st all Consular invoices must be purchased at Salvador Consular Office at a cost of 10d. per set (four copies). Consequently, no Consular invoices will be certified by Salvador Consuls at London, Liverpool, Birmingham, Glasgow and Southampton, unless the proper official forms have been so procured.

COLUMBIA.—The Board of Trade have been informed that a new Customs Tariff was promulgated on December 18th. Increases of the former rates of duty will begin after the expiration of 90 days from December 6th last by steps of one-tenth during 10 months. The new tariff will consequently not be in full force until January, 1915.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

19. "Electrical apparatus for heating and cooking." E. W. LANCASTER. January 1st.

20. "Electric heating and cooking apparatus." E. W. LANCASTER. January 1st.

38. "Electrodes for alkaline accumulators." SVENSKA ACKUMULATOR AKTIEBOLAGET JUNGNER. January 1st. (Convention date, January 16th, 1913, Sweden). (Complete).

53. "Semi-automatic telephone exchange systems." W. AITKEN and R. AITKEN. January 1st.

65. "Electric torch ray magnifier." T. J. WILLIAMS. January 1st.

66. "Electrical apparatus for imparting intermittent motion at predetermined intervals." A. C. BANFIELD. January 1st. (Complete).

68. "Electric arc lamps." H. J. BOOKER. January 1st.

72. "Process for restoring the activity of a positive electrode mass for alkaline accumulators." SVENSKA ACKUMULATOR AKTIEBOLAGET JUNGNER. January 1st. (Convention date, January 16th, 1913, Sweden). (Complete).

73. "Means for applying electric power to assist or supplement hand power for steering or other purpose." W. H. SCOTT. January 1st.

83. "Apparatus for converting telegraphic code figures into words." A. W. C. VOIGTSBERGER, H. WEST, and J. WEST. January 1st. (Addition to 9,195/12). (Complete).

91. "Means for intermittently establishing an electric circuit for indicating or recording the level of liquids or for other purposes." J. B. HOTHAM and M. J. WILSON. January 1st. (Complete).

106. "Packing enclosure for the cells of an electric battery." B. PORDES. January 2nd. (Complete).

111. "Instruments for indicating the phase relations of alternating current circuits." EVERETT, EDGCUMBE, & Co., LTD. January 2nd.

123. "Rising receptacles for electrical accumulator cells." SVENSKA ACKUMULATOR AKTIEBOLAGET JUNGNER. January 2nd. (Convention date, January 16th, 1913, Sweden). (Complete).

124. "Dynamo-electric machines." BRITISH THOMSON-HOUSTON CO., LTD., and A. A. POLLOCK. January 2nd.

125. "Lighting fixtures." BRITISH THOMSON-HOUSTON CO LTD. January 2nd. (General Electric Co., United States).

133. "Electric lamps fed by induction-apparatus driven by irregular actuating-means." F. ESTEVE. January 2nd. (Convention date, January 4th, 1913. France). (Complete).

134. "Electric safety lamp for mines." W. KRAUSHAAR. January 2nd. (Convention date, January 7th, 1913, Germany). (Complete).

136. "Electric heaters." J. R. QUAIN. January 2nd.

155. "Holders for electric incandescent lamps and the like." E. H. B. HUGHES. January 3rd.

165. "Gas controllers, electric time switches, and the like." E. H. HORSTMANN, G. O. H. HORSTMANN, A. HORSTMANN, S. A. HORSTMANN, and W. T. EDGAR. January 3rd.

173. "Machines for generating electrical energy." C. T. MASON. January 3rd. (Complete).

174. "Machines for generating electrical energy." C. T. MASON. January 3rd. (Complete).

183. "Dynamo-electric machines." J. D. L. BRADWELL and G. BRADWELL. January 3rd.

186. "Metal vapour rectifiers or the like." AKT. GES. BROWN, BOVERI, ET CIE. January 3rd. (Convention date, March 22nd, 1913, Germany). (Complete).

188. "Apparatus for heating rooms and buildings by electricity." F. SUMNER-SMITH, E. P. BARFIELD, and J. ST. C. COLSON. January 3rd.

194. "Detectors for radio-telegraphy or telephony." E. WILSON. January 3rd.

196. "Electrical coupling devices for railway and other vehicles." L. BOIRAULT. January 3rd. (Divided Application on 21,480/13. September 23rd). (Complete).

198. "Apparatus for the control from a distance of a number of guns from a single transmitter." R. GIRARDELLI. January 3rd. (Convention date, January 16th, 1913, Italy). (Complete).

208. "Life-saving device particularly applicable to electric tramways and the like." J. GYARMATI, I. LAKY, and J. LASZLO. January 3rd.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

21,191. APPARATUS FOR DISPLAYING ADVERTISEMENTS, COMMUNICATING MESSAGES OR SIGNALLING BOTH DURING LIGHT AND DARKNESS. J. P. Naylor & Naylorgraph, Ltd. September 17th.

28,634. ELECTRIC CURRENT REGULATING AND CONTROLLING APPARATUS, SUCH AS ELECTRIC-MOTOR STARTING AND CONTROLLING APPARATUS AND THE LIKE. J. A. Hirst and P. S. Brook. December 12th.

28,748. MACHINES FOR GENERATING ELECTRIC CURRENT FOR DUAL PURPOSES SUCH AS IGNITION AND ILLUMINATION. F. L. Hollister. December 13th.

28,864. ELECTRO-MAGNETS. Soc. Anon. des Etablissements L. Bleriot. December 14th. (December 15th, 1911).

28,924. LIGHT PROJECTING APPARATUS FOR ATTACHMENT TO SMALL ARMS. Waffen-Technische Ges. "Wespi." December 14th.

28,943. MEANS FOR USE IN THE QUANTITATIVE ANALYSIS OF GASEOUS MIXTURES AND FOR AUTOMATICALLY REGULATING THE STATE OF GASEOUS MIXTURES. Siemens Bros. & Co. (Siemens & Halske Akt. Ges.). December 16th.

28,977. ELECTRIC CIRCUIT CLOSING APPARATUS. H. Wade (Protective Signal Manufacturing Co.). December 16th.

29,031. SIGNS OR DEVICES FOR ADVERTISING AND DANGER SIGNAL PURPOSES. A. Crowden. December 17th.

29,338. REGULATION OF THE PRESSURE OF ELECTRICAL GENERATION SYSTEMS EMPLOYING ROTARY CONVERTERS. Siemens Bros. Dynamo Works, Ltd. and Wilson, J. C. December 20th.

29,357. TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co. (Automatic Electric Co.). December 20th.

29,387. TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co. (Automatic Electric Co.). December 20th.

29,389. REFRACTORY MATERIALS. British Thomson-Houston Co. (General Electric Co.). December 20th.

29,581. MAGNETO-ELECTRIC MACHINES FOR COMBINED IGNITION AND ILLUMINATING PURPOSES. F. R. Simms. December 23rd.

30,047. ROTARY ELECTRO-PLATING APPARATUS. C. J. Charlton. December 31st.

1913.

88. ELECTRIC SWITCHES FOR USE IN COMBINATION WITH ELECTRO-MECHANICAL GEAR-CHANGING MECHANISM ON AUTOMOBILES. F. Beemer. January 1st.

882. ELECTRICITY METERS OF THE MERCURY MOTOR-DISC TYPE. W. Lawson. January 10th.

1,259. TELEPHONE RECEIVER ATTACHMENT. A. O'Hare. January 16th. (May 22nd, 1913).

2,001. WIRE DRAWING. British Thomson-Houston Co. (General Electric Co.). 24th January.

2,509. TELEPHONE EXCHANGE SYSTEMS. Western Electric Co. (Western Electric Co.). January 30th.

2,718. ELECTRIC FURNACES. F. C. Wardall and J. Marchant. February 3rd.

2,901. ELECTRIC INCANDESCENT LAMPS. British Thomson-Houston Co. (General Electric Co.). February 4th.

5,448. VAPOUR ELECTRIC DEVICES. British Thomson-Houston Co. (General Electric Co.). March 4th.

6,143. ELECTRIC INCANDESCENCE LAMPS. H. Zschocke. March 12th.

6,664. CIRCUIT ARRANGEMENTS FOR SEMI-AUTOMATIC TELEPHONE SYSTEMS. Siemens & Halske Akt. Ges. March 18th. (March 19th, 1912).

7,348. TELEPHONE RECEIVERS AND THE LIKE APPARATUS. M. S. Conner. March 28th.

9,381. ELECTRO-FURNACE. P. Eyermann. April 21st.

9,579. SECURING OF ELECTRIC LAMPS IN THEIR SOCKETS. R. J. Bott. April 23rd. (Cognate Application, 11,245/13).

10,535. ELECTRIC MOTORS. M. J. Railing and J. Colf. May 5th.

11,267. REGULATION OF ELECTRIC CIRCUITS AND MEANS THEREFOR. Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke Ges.). May 14th.

11,852. ELECTROSTATIC APPARATUS FOR SEPARATING AND CLEANING GRITS, GRAIN, SEEDS, OR THE LIKE. J. Kraus. May 21st. (April 30th, 1913).

12,235. ELECTRICALLY-DRIVEN AUTOMATIC LATHES. H. Kienzle. May 26th.

15,568. PROCESS AND APPARATUS FOR MAKING MICA SHEETS. Meirowsky and Co. Akt. Ges. July 5th. (July 22nd, 1912).

15,769. SYSTEMS FOR SUPPLYING FROM HIGH-PRESSURE MAINS CONTINUOUS CURRENT AT A LOWER PRESSURE. E. A. Graham and W. J. Rickets. July 8th.

16,128. MONEY-BOXES FOR APPARATUS SUCH AS PREPAYMENT TELEPHONES, COIN-FREED GAS METERS, OR THE LIKE. H. G. C. Fairweather (Ges. fur Elektrische Industrie). July 12th.

16,998. ELECTRIC RESONANCE OPERATED APPARATUS. H. W. Handcock, A. H. Dykes, and W. Duddell. July 24th. (Addition to 1,395/13).

18,474. MERCURY MOTOR ELECTRICITY METERS. Chamberlain & Hookham, Ltd. and S. Holden. August 14th.

19,122. APPARATUS FOR DISPLAYING ADVERTISEMENTS, COMMUNICATING MESSAGES, OR SIGNALLING BOTH DURING LIGHT AND DARKNESS. J. P. Naylor and Naylorgraph, Ltd. August 22nd. (Divided Application on 21,191/12. September 17th).

19,190. REFLECTORS FOR SEARCH LIGHTS. Optische Anstalt C.-P. Goerz Akt. Ges. August 23rd. (August 28th, 1912).

21,965. INDICATORS, ANNUNCIATORS, AND THE LIKE. Sterling Telephone and Electric Co. (Telephon-Fabrik Akt. Ges. vorm. J. Berliner). September 29th.

23,728. RADIATING SYSTEM FOR SIGNALLING BY ELECTRIC WAVES FROM AEROPLANES. Signal Ges. October 20th. (November 27th, 1912. Addition to 736/13).

25,073. ARRANGEMENTS FOR CONNECTING TWO ELECTRICAL SOURCES IN PARALLEL. Siemens Schuckertwerke Ges. November 3rd. (June 7th, 1913).

27,355. MAGNETO-ELECTRIC MACHINES. F. L. Hollister. November 27th. (Divided Application on 28,748/12. December 13th).

27,356. DYNAMO ELECTRIC GENERATORS. F. L. Hollister. November 27th. (Divided Application on 28,748/12. December 13th).

27,452. CIRCUIT ARRANGEMENTS FOR TELEPHONE SYSTEMS. Siemens & Halske Akt. Ges. November 28th. (November 28th, 1913).